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GO HOLLYWOOD?**

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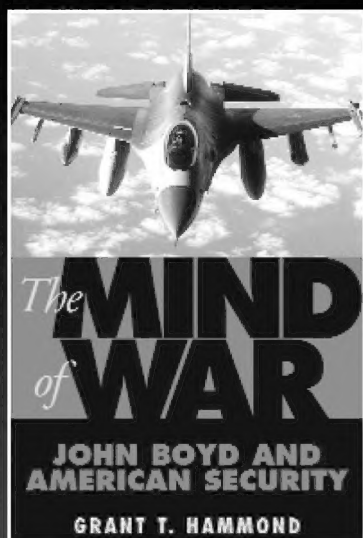
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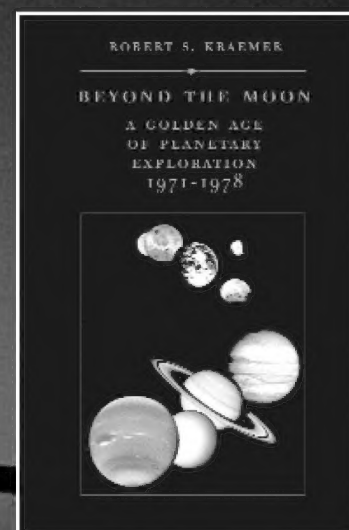
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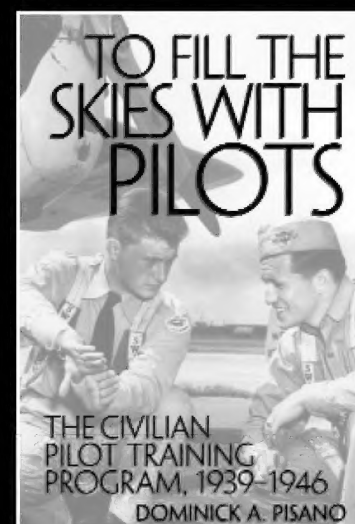
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# AIR & SPACE

Smithsonian

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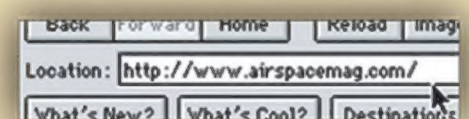
#### Cover:

*When a British Airways crew landed their Concorde at Shannon Airport, Ireland, in August 1999, John Dibbs and his camera were there to meet them.*

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*"I've lived aviation history..."*



**"So much historic hardware is in dark storage today. But it will soon be brought to light at the Udvar-Hazy expansion. That's why we included the Museum in our estate plans — so the public may see what we saw."**

— COLONEL AND MRS. JOSEPH S. BENHAM, USAF (RET.) IN THE WWII GALLERY. Just behind them on the left is the service uniform of the General of the Army Henry Harley "Hap" Arnold, Commanding General, US Army Air Forces, WWII. On the right is his flag when he served as the first General of the U.S. Air Force

PHOTO: ERIC LONG

His dreams of flying came true during World War II, in P-40's and other warplanes. Then he volunteered to fly jets in Korea. He spent 30 years serving with the U.S. Air Force. With a lifetime in aviation behind him, he stays involved, attending reunions, and visiting the Museum and restoration facilities.

The Benhams believe the National Air and Space Museum is essential to awareness of the depth and

breadth of aviation. They've created a gift annuity *and* included the Museum in their living trust, and are proud members of the *Smithsonian Legacy Society*.

Find out how you can give to the National Air and Space Museum or include us in your estate plans. Fill out and return the reply form, or call 202-357-2493. You may also e-mail [gayle.union@nasm.si.edu](mailto:gayle.union@nasm.si.edu). Enlighten everyone about the history of flight!

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## The Big Two-Five

As birthdays go, 25 is a milestone that marks the passage from youth to maturity, and for the National Air and Space Museum, hitting the quarter-century mark was a very similar event. On July 1 the Museum celebrated its birthday with just over 67,000 visitors—exceptional Sunday attendance in a building that has welcomed some 219 million visitors since it opened its doors in 1976. From preschoolers cheering the “Battle of the Blimps,” to teenage sleuths identifying “Who am I?” historic characters, to someone like me enthralled by curators’ descriptions of the icons of aviation and space history, they came to blow out the candles and wish the Museum a future as successful as its past.

And they’ll get their wish.

At the opening ceremony during the nation’s 1976 bicentennial celebration, President Gerald Ford called the Museum “a perfect birthday present from the American people to themselves.” Those words have inspired the silver anniversary theme as well: The perfect birthday present will keep on giving with a year-long series of events. Visitors on July 1 were treated to 25 special “presents”—activities, games, performances, and souvenirs. And when the anniversary year ends next summer, the American people will celebrate another gift: the Steven F. Udvar-Hazy Center. The first phase of the Museum’s eagerly anticipated companion facility is expected to be completed in late 2002 to enable exhibit installation in time for opening the following December.

Each month throughout the silver anniversary year, we will showcase something that focuses on the Museum’s collections or a milestone in aviation or

space history. From August until June, we will launch new exhibitions, premiere a summer film festival, unveil an innovative projection system in the Albert Einstein Planetarium, publish several books, and debut IMAX films.

A new gallery, “Explore the Universe,” will open on September 21. This permanent exhibition will show how we arrived at our current scientific view of the universe and probe the mysteries that remain. Encompassing an array of artifacts spanning the past 400 years—including astronomer William Herschel’s 20-foot telescope—the exhibition will lay out our astronomical progress within its historic and technological context.

New publications will include the *Smithsonian Book of Flight*, a children’s book; *At the Controls: NASM Book of Cockpits*; *Great Aviators and Epic Flights*; *The Nation’s Hangar*; and *The Spirit of St. Louis*.

Other anniversary year highlights will include a lecture by Reeve Lindbergh commemorating the 75th anniversary of her father’s transatlantic flight; “Voyage,” an exhibit on the National Mall, focusing on the solar system; “At the Controls,” a Smithsonian Traveling Exhibition based on the book; and new CD-ROMs on the planets and on aircraft and spacecraft in the Museum’s collection.

For 25 years the National Air and Space Museum has succeeded beyond all expectations, becoming the foremost destination to view the icons of flight and to learn about the people and science that got them off the ground. As we celebrate our first quarter-century, it’s clear that the best is yet to come.

—J.R. Dailey is the director of the National Air and Space Museum.

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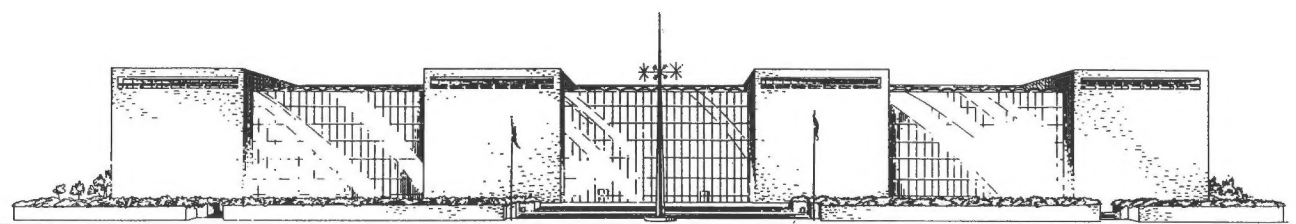
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## One Fast Mama

I recall that B-52 no. 008 played a role in the decision to develop the space shuttle ("Mother," June/July 2001). Early on in the testing of the lifting bodies, many in NASA argued that while a small lifting body could perform the high-energy descent to landing, it was unreasonable to suppose that a heavier body like the shuttle could. Since there were no large lifting bodies to test, it seemed the space shuttle would not move forward. Salvation, in the form of a B-52, was just around the corner.

After a drop launch in the M2-F3 lifting body, test pilot Jerry Gentry landed, rolled to a stop, and opened his canopy to climb out. He was almost immediately dusted by a B-52 flat-hatting across the lake bed. He was somewhat surprised to note that this was the very B-52 that had dropped him at altitude and had somehow managed to follow his high-energy descent. The pilot of the B-52 revealed his technique: Engines to flight idle, bleed off airspeed, gear down, speed brakes out, point nose toward earth, and hold speed to gear-down redline. It was clear that a large and heavy aircraft could be flown in the same manner as the smaller lifting body.

Perhaps the space shuttle really should send a Mother's Day card to 008.

—Scott Searcy  
Forest City, Iowa

## Gone With the Wind

It was nice to see a Helio Courier in your pages, even if the condition of the airplane was disappointing ("Reading the Wreckage," June/July 2001). Please furnish more details of the accident. The picture generates more questions than it answers. The flaps are retracted, the rudder appears to have impacted downward, and the distance from the wing to the top of the cowl seems to have been severely decreased. It appears the cause was a landing stall high enough to produce a severe nose-down attitude, with the landing gear and prop hitting first, followed by a complete inverted roll. It seems that a much more probable cause was a typical Oklahoma wind storm tossing the Helio on its back.

—Ralph Gaston  
Bellevue, Washington

*Eric Adams replies: You're absolutely right. That aircraft is the Transportation Safety Institute's "trick question." It used to be a training*

*aircraft at the Federal Aviation Administration's Oklahoma City facility, but one afternoon some students left without tying it down. A wind storm later whipped through bearing 45-mph winds. Since the Helio Courier will become airborne at only 30 mph, it quickly did. As TSI instructor Andy McMinin tells it, air traffic controllers saw the unoccupied airplane flying around the airport during the storm. It crashed three times before finally landing inverted. Not many students can figure that one out.*

## Objects in Mirror

The caption for the photograph of the Boeing 747 panel in the article "Strong Light" (June/July 2001) quotes the photographer as saying she choreographed the shot. Evidently the negative of the photo was also choreographed in the darkroom, as "Northrop" appears backwards on the three workers' shirts.

—Sanford Solarz  
Levittown, Pennsylvania

*Editors' reply: You've never heard of gonstrov? That was our own inadvertent choreography—otherwise known as flopping the photo.*

## Corporate Pride

"Dog of War" (June/July 2001) failed to mention that the performance of the H-34 in Vietnam exemplified one of Igor Sikorsky's greatest sources of pride. His creation, the helicopter, unique among military tools, has saved many more lives than it has taken.

—Alan Clarke  
Oxford, Connecticut

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# Ryan's Greatest Hit

*"This morning I'm going to test the Spirit of St. Louis.... What a beautiful machine it is, resting there on the field in front of the hangar, trim and slender, gleaming in its silver coat! All our ideas, all our hopes lie there before me, waiting to undergo the acid test of flight. For me it seems to contain the whole future of aviation."*

Not long after logging those notes in April 1927, Charles Lindbergh rumbled down the runway at Dutch Flats Airport on the waterfront in San Diego, California, in a high-wing monoplane patterned after the Ryan M-1 mailplane. It was a brisk, breezy spring morning, and some 35 employees of Ryan who had worked day and night for 60 days to build the airplane—which they called “the 60-Day Wonder”—had gathered on the field. “We all sort of held our breath to see—Will it fly? Because no one really knew,” remembered Georgia Matthias Borthwick, 94, the last living eyewitness to that test flight.

Just 165 feet and six seconds later, “Slim,” as Lindbergh was known, was airborne. “Everybody cheered and clapped and went crazy as he circled overhead,” Borthwick recalled. Less than a month later, he left New York for Paris.

Last April 28, 74 years to the day after that test flight, American Institute of Aeronautics and Astronautics president Sheila Widnall dedicated Dutch Flats as a Historic Aerospace Site before some 200 people, including Eric and Morgan Lindbergh, grandsons of Charles and Anne Morrow Lindbergh; Nova Hall, grandson of aeronautical engineer Donald Hall, who designed the *Spirit* with Lindbergh; and Jerome Ryan, son of T. Claude Ryan, founder of Ryan Airlines, now Ryan Aeronautical Center Northrop Grumman.

The airport is long gone, so the ceremony was held at the San Diego Aerospace Museum Pavilion of Flight in Balboa Park. “In this disposable five-second sound bite age, the early efforts



SAN DIEGO AEROSPACE MUSEUM

of those who labored to make our lives better often go unmarked,” Widnall, a former Secretary of the U.S. Air Force, told the assemblage as she unveiled a commemorative plaque now hanging in the U.S. Post Office that occupies the site. “But we are here to say to those who have gone before: Your work is not forgotten.”

AIAA established the Historic Aerospace Sites Program last year to promote the preservation of sites where aerospace’s greatest accomplishments occurred. Initially, five sites were chosen: Dutch Flats, the Rocket Site at Edwards Air Force Base, the first Aerojet Corporation manufacturing plant in Pasadena, California, Aunt Effie’s Farm in Auburn, Massachusetts, where Robert

Goddard first successfully launched a rocket, and Tranquillity Base, the moon site where Apollo 11 touched down. (The plaque for Tranquillity Base hangs in the National Air and Space Museum—“a good dodge if we can’t get back to the moon,” Widnall quipped.) Another six sites will be recognized in 2002.

“Most people pick up the Lindbergh story in New York, because that’s where the flight began officially, but the real work occurred in the days leading up to that, and that happened here,” said Bill Chana, past president of the museum, member of the AIAA Historic Sites 2000 committee, and a veteran engineer, test pilot, and aircraft designer.

The one thing most people don’t know, Georgia Borthwick said, is that



Lindbergh's flight was nearly inadvertently sabotaged. "After the initial test flight, they did a load test flight up at Kearny Mesa [Camp Kearny Parade Grounds, now Marine Corps Air Station Miramar]. When they were taking the gas out with a siphon, one of the mechanics dropped his hose into the tank. Another mechanic standing there said, 'Don't worry. It'll dissolve.' But Fred Rohr, who did all the sheet metal on the airplane, said: 'You cannot let that hose stay in the gas tank. We're going to have to cut a hole in the fuselage and take it out.' Slim never would have made it if Fred Rohr didn't happen to hear those mechanics." (The hose could easily have blocked fuel flow to the engine.)

Ray Cote, the first pilot of the San Diego Aerospace Museum's *Spirit of St. Louis* replica, now in the museum rotunda, recalled the feel of the airplane from his 13 takeoffs and landings. "You had to hang onto the stick—it had a baseball-bat-sized stick and you used two hands—and you just accepted the fact that it wasn't a perfectly aerodynamic airplane."

"Grandfather wanted a certain amount of instability to help keep him awake," Eric Lindbergh said, "but what Ray didn't mention was that it just wouldn't fly straight." Eric flew a replica at the 1998 Experimental Aircraft Association fly-in at Oshkosh, Wisconsin. "You could point it and get it going straight and you'd concentrate on the rudders and it would be off, then concentrate on ailerons and it would go off. It was constant. If you had winds, it would blow you off even though you were holding your heading. It freaked me out too, because you couldn't see out the front."

"I still don't understand how Grandfather flew that plane for hours and stayed on course with no visual references over the ocean," he mused. "And how he did it for 33 hours—*whoa*."

—A.J.S. Rayl

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The Hughes Flying Boat, the largest airplane ever flown, now dominates a new museum in the diminutive Oregon town of McMinnville, at the Captain Michael King Smith Evergreen Aviation Educational Institute.

Having outbid seven competitors to own the fabled transport, the institute celebrated the HK-1's restoration in progress on June 6, the anniversary of D-Day, to honor local veterans. The institute's B-17 and P-51 made flybys in skies that stayed clear, despite the area's reputation for rain. Nearly 4,000 first-day visitors viewed the unique main attraction and more than two dozen others, including an airworthy Messerschmitt Bf 109G, a Convair F-102A, a de Havilland DH-100 Vampire, a Northrop T-38, a Chinese MiG-15, and a McDonnell Douglas F-15A.

Michael Smith, the former Air Force pilot for which the facility is named, had the idea to bring the flying boat to McMinnville. After he died in a 1995 car crash, his father, Del Smith, became the driving force, financially and emotionally, to realize the dream. The elder Smith, once an Air Force helicopter pilot, said, "We succeeded because of the remarkable proposal Mike made to be the plane's guardian."

—Bob McCafferty

## UPDATE

### Hyper-X Setback

NASA's X-43A hypersonic research vehicle and its Orbital Sciences Pegasus XL booster ("The NeXt Generation," Dec. 1999/Jan. 2000) were air-launched from NASA's B-52 at 24,000 feet on June 2 at the Dryden Flight Research Center in California; after the two elevons on the booster came off about 8 seconds after solid rocket motor ignition, the craft went out of control. Engineers triggered the booster's self-destruct mechanism 51 seconds after the launch. The hypersonic scramjet engine research program will forge ahead with another two test vehicles.

## Airshow Lite

The loudspeakers blared the "The Star Spangled Banner" as everyone squinted against the morning sun. At first there were just four dots, far off to the east. A moment later—still dots, but larger now. Finally the dots morphed into airplanes, flying in ragged formation. Their blue, red, white, and orange fabrics glowed in the sun and their engines buzzed mightily as they passed—at a ripping 50 mph.

"Ultralights are slow," says Tom Gunnarson, executive vice president of the U.S. Ultralight Association. "They're not for transportation or commerce. They're just for fun."

The seventh annual "World's Smallest Air Show," held Memorial Day weekend at Brian Ranch Airport near tiny Llano in California's Antelope Valley, 90 miles east of Los Angeles, is a celebration of ultralight flying staged by airport owners Felice Apodaca and Jack Brian. "We wanted to fill a niche," says Apodaca, "to show the kind of airplane that will make people say, 'I could do that too.'" There is no admission charge. "We try to make enough selling T-shirts and memorabilia to break even on the rented Porta-Potties," she says. "Otherwise, this is all about fun."

Ultralights do make powered flight easily accessible. But you might want something to keep the bugs out of your



teeth. In protection from the elements, the classic ultralights fall a notch below open-cockpit machines, with the pilot sitting out front—ahead of wing, engine, and propeller. In a “trike” model, the pilot sits in what resembles a tricycle-gear-equipped lawn chair suspended from a triangular wing. These “Part 103 Legal” machines (referring to Part 103 of the Federal Aviation Regulations) require no certification, license, or medical certificate to fly, but the USUA advocates at least 10 hours of training.

Ultralight manufacturers have developed larger and more powerful models, some with enclosed cockpits, which are covered by more stringent FAA regulations. Many of the machines flying at Brian Ranch were these “fat ultralights.” Most of that flying was pretty tame: a dust-raising takeoff from the dirt runway followed by a climbing right turn out over the Joshua trees and sagebrush, then a few tight spirals or other maneuvers and a return to the pattern.



Less tame was the unorthodox competitive flying. Ultralights of all sizes, shapes, and colors did the bombing run (climb to 100 feet and drop a beanbag on a target), torpedo run (come in as low as possible and toss the beanbag under a sawhorse), and carrier landing contest (land as close as possible, without bouncing, to a designated spot).

Volunteers in international-orange safety vests kept score for the official USUA rankings and gathered up the beanbags.

By midday the desert winds were making flying pretty sporty. Many of the thousand or so

spectators passed the time visiting the vendors—the Llano Community Association’s bake sale, Chuck’s Hot Dogs, and Apodaca’s collectibles and T-shirt table. For \$30, a visitor could ride along in ultralight instructor Bob Comperini’s two-seat Quicksilver. One who did said he might never stop grinning.

—Stan Solomon

## UPDATE

## Early Retirement

An unmanned reconnaissance and surveillance aircraft, Predator RQ-1 number 009, which flew some 1,700 hours in the Balkans (“Predator: First Watch,” Apr./May 2001), is now hanging in the U.S. Air Force Museum at Wright-Patterson Air Force Base in Ohio. Number 009 first flew in August 1995 and logged nearly 3,000 hours making 448 flights before coming off active flight status in June 2000. It is displayed equipped with a U.S. Army Hellfire missile, which was the weapon that struck tanks from an altitude of 2,000 feet during tests last February at Nellis Air Force Base in Nevada. The Predator program is now in Phase II testing, which requires the UAV to strike moving targets from higher altitudes.

## Running on Empty

Spacecraft of the future may be able to fly with their fuel tanks on empty, if they use a propulsive tether concept that will be tested in Earth orbit in March 2002. The NASA experiment will use an electrodynamic tether to try to deorbit a spent Delta 2 rocket stage. It’s the first demonstration of a propellant-free propulsion system, which some day could be used to deliver commercial telecommunications satellites to their final orbits, reboost the International Space Station, and even send an



A composite of photographs taken in late May shows the final-assembly lines for the C-130J Hercules and the F-22 Raptor at Lockheed Martin’s 3.5-million-square-foot main factory in Marietta, Georgia. From the far left, the C-130J’s mid fuselage is built up, cargo floor through

fuselage, center wing mate, wing and wheel fairing installation, and landing gear installation (A). The complete empennage and forward fuselage are then mated to the mid fuselage (B). The wings (not yet installed) are mated next (C), followed by engines, propellers, and avionics (D).



interplanetary probe to Jupiter.

"At first blush, it seems like getting something for nothing," says Les Johnson, manager of in-space transportation technologies at NASA's Marshall Space Flight Center in Huntsville, Alabama, and chief scientist on ProSEDS, the Propulsive Small Expendable Deployer System. The \$10 million experiment will be launched from Florida's Cape Canaveral on the second stage of a Delta 2 rocket. Once in low orbit, the stage will reel out a tether—a 9-mile-long array of fine wires wrapped around a Kevlar core. Three miles of it will be uninsulated aluminum designed to conduct electricity as it sweeps through the low-density plasma of the ionosphere. As the wire attracts electrons, the developing electric current will create a magnetic field. By pushing against Earth's magnetic field, the tether will slow the stage and lower its orbit three to six miles a day for several days. Although it is as thin as dental floss, the

## UPDATE

### Kistler, Rejuvenated

Kistler Aerospace has won a NASA Space Launch Initiative contract to continue work on the company's K-1 reusable launch vehicle ("Rockets for the Rest of Us," Feb./Mar. 1998). Kistler ran out of money in 1999 and stopped work on the RLV after spending \$500 million, and now must raise another \$500 million. NASA can cancel the contract in March 2003 if the K-1 has not made substantial progress toward flying.

## HEADS UP

### National Championship Air Races

2001: The Race Odyssey  
September 13–16  
Stead Field, Reno, Nevada

Reno Air Racing Association  
PO Box 1429, Reno, NV 89505 Phone  
(775) 972-6663 [www.airrace.org](http://www.airrace.org)



RICHARD VANDER MEULEN

This year's Reno Air Races will include the debut of jet racing, with an invitational event featuring six Aero Vodochody L-39 Albatros jets. A partial roster of pilots includes former shuttle command pilots Curt Brown and Robert "Hoot" Gibson (piloting the L-39 above in trials at Reno last June); last year's Unlimited champion, Skip Holm; and former T-6 champion and Federal Express pilot Mary Dilda. Another Reno highlight is the first Apollo Astronaut Reunion, in which 14 Apollo astronauts will join Reno grand marshals Gene Cernan and Dick Gordon. Performing at Reno's airshow are Delmar Benjamin and his GeeBee, the Smirnoff MiGs, and the U.S. Navy's Wall of Fire, which features top-flight tactical military aircraft.

tether should be visible from Earth.

"The whole idea of getting propulsion by a wire interacting with Earth's environment is a gee-whiz idea," says Johnson. Experimental tethers—without conducting wires—have flown in space three times to show that tethers can be deployed and controlled. A space shuttle tether mission proved that an insulated copper wire can generate current, giving scientists more hope for the ProSEDS experiment that was in parallel development.

If the ProSEDS experiment works, future experiments will demonstrate the use of tethers for boosting spacecraft orbits. Scientists say a tether propulsion system developed for \$50 million could help the International Space Station maintain its orbit 235 miles up, saving \$2 billion in propellant costs over 10 years. Some have suggested Jupiter's energetic magnetosphere is an ideal environment for a tether-operated probe.

—Beth Dickey



LOCKHEED MARTIN

The next steps are functional test (E), company shakedown (no aircraft was in company shakedown at the time) (F), and customer shakedown (G). The overhead doors are opened and the C-130J is towed out to be painted (H). The F-22 assembly line has been temporarily

shifted to the east end of the building with the C-130Js while the west end of the building is being renovated. From the left, Raptor 4012 (the company number for the 12th F-22) has received its wings (I). The vertical tails have been added to Raptor 4011 (J). The rudders have been

installed on Raptor 4010 (K), and the Pratt & Whitney F119-PW-100 engines have been installed in Raptor 4009 (L), the last of the program's test aircraft, which will be delivered to the Air Force Flight Test Center at California's Edwards Air Force Base early next year.





## The Coming Out Party

On a beautiful day last May, the airplanes were out at the Paul E. Garber Preservation, Restoration and Storage Facility in Suitland, Maryland. Normally, Garber's inventory of air and space artifacts is sealed in a cluster of windowless buildings, but on this day three flawless specimens—an Aichi Seiran floatplane, a Pitts Special biplane, and a Hawker Hurricane—had been rolled out onto a driveway that runs between the buildings. As the airplanes basked in the warm air, a crowd of more than 100 admirers stared appreciatively, many of them taking pictures like proud parents photographing their babies.

The day was a quiet celebration for dozens of Garber employees and volunteers, who had worked for years to restore the three aircraft, all part of the collection of the National Air and Space Museum. "On the day of the roll out, I felt—'Finally!'" says Tom Alison, who oversees the Garber facility. For the airplanes, their moment of freedom was brief; shortly after noon they were

brought back inside. The Hurricane and the tiny Pitts went willingly, but it took some 20 people to slowly push and angle the 8,000-pound Seiran through the large hangar doors of Building 10. By this time, chairs had been lined up next to Building 10's lunchroom, and everyone sat down to a meal of hot dogs, burgers, potato salad, and baked beans. Elvis Presley tunes played on a boom box as people ate and swapped airplane stories. The Seiran loomed commandingly in the background, perched high upon its massive floats.

The Seiran was designed by the Japanese to launch from a submarine and bomb the Panama Canal during World War II. It entered Building 10 in November 1989. There, paid and volunteer restoration technicians



*The Museum's Hawker Hurricane Mark IIC (top) never saw combat, but other Hurricanes (above) gave British fighter pilots the means to defeat the Germans in the skies over England during World War II.*

worked on it through March 2000. "On the one hand, I'm glad that the project is complete," says Garber restorer Bob McLean. "But I will miss the detective work of

unraveling mysteries [about the airplane's history] and the camaraderie of the worldwide 'Seiran family.'"

The Museum's Hurricane served as a trainer for British fighter pilots during the waning days of World War II, and the Pitts biplane is an aerobatic craft flown by championship pilot Betty Skelton Frankman, who named it *Little Stinker* (see *In the Museum*, Aug./Sept. 1998). The restoration of *Little Stinker* required 6,037 man-hours and cost \$45,575. For the Hurricane and the Seiran, the labor costs alone come to more than \$1 million for each airplane.

In October, *Little Stinker* will go on





ERIC LONG



COURTESY OZAKI FAMILY AND TETSUKUNI WATANABE

Last May 3, Garber employees rolled out three recently restored aircraft: a Hawker Hurricane (opposite), an Aichi Seiran (top, left), and a Pitts biplane. Japan surrendered before the Seiran (above) could complete even a single mission.



COURTESY BETTY SKELTON FRANKMAN

Betty Skelton Frankman, an aerobatic pilot, won two championships in Little Stinker, a Pitts Special S-1C biplane.

temporary display in the National Air and Space Museum as part of an exhibit on aerobatic aircraft. Within days of the rollout, however, the Seiran was completely disassembled and the Hurricane had its wings removed. Both aircraft will remain in storage at Garber until they go on permanent display at the Steven F. Udvar-Hazy Center at Washington Dulles International Airport in Virginia. Since the Hazy center is not expected to open until December 2003, how sweet that the airplanes had their day in the sun.

—Diane Tedeschi

## MUSEUM CALENDAR

**September 1, 8, 15, 22, 29** Flights of Fancy Storytime for Children. Traveling far from home can be scary. What if you were going to Mars? What should you bring? This month's stories will help children ages three to seven in planning their voyages. Reservations required one week in advance. Call (202) 786-2107. How Things Fly gallery, 11:30 a.m.

**September 21** "Explore the Universe," a major new permanent exhibition, opens at 10 a.m. The artifact-rich exhibition showcases the most significant observational tools astronomers have devised over the past two centuries. "Explore the Universe" invites visitors to experience the wonders and achievements of cutting-edge observational astronomy.

### Curator's Choice

Once a week a Museum curator will give a 15-minute talk about an artifact. Meet at the Museum Seal near the Information Desk at noon. Aug. 1,

"The CRAY-1 Supercomputer"; Aug. 8, "Ira C. Eaker: U.S. Army Air Corps Pioneer"; Aug. 15, "The 1934 Airmail Crisis"; Aug. 22, "The Voisin VIII: Early Night Bomber"; Aug. 29, "Lunar Orbiter: Mapping the Moon."

### Samuel P. Langley Theater

Experience the thrill of films produced in IMAX and projected onto a screen seven stories wide and five stories high. Feature films include *To Fly!* and *Solar Max*. For more information, visit [www.nasm.edu](http://www.nasm.edu) or call (202) 357-1686.

### Albert Einstein Planetarium

Embark on a celestial adventure. Realistic astronomical experiences are produced under the planetarium's 70-foot dome. For information, call (202) 357-1686.

*Except where noted, no tickets or reservations are required. To find out more, visit [www.nasm.edu](http://www.nasm.edu) or call Smithsonian Information at (202) 357-2700; TTY (202) 357-1729.*



## “Cleared in Hot”

he days had started to blur together. Some pilots had started calling it Operation Groundhog Day. Twice a day, a U.S. E-3 Airborne Warning and Control System aircraft would lumber down the single runway at Incirlik Air Base in southeastern Turkey and head toward Northern Iraq, disappearing on the eastern horizon. Twenty minutes later, two tankers, a U.S. KC-135 and a British VC-10, would follow. Ten minutes after that, we would take off in F-15C Eagles (right).

The tactical departure was one of the most fun parts of the sortie. Because of the threat of shoulder-launched surface-to-air missiles (SAMs), we would take off in full afterburner, pulling the jets into a near-vertical climb at the end of the runway to get us quickly away from the threat. It always amazed me how the jet could climb so quickly when loaded with three 600-gallon external fuel tanks and eight missiles.

Our mission that day in March 1994, as it was every day, was to enforce the no-fly zone over northern Iraq. We had orders to warn and then shoot down Iraqi combat aircraft above the 36th parallel. Two no-fly zones had been operating in both northern and southern Iraq since the end of the Gulf War. Along with a gaggle of over 30 U.S., British, and French aircraft, it was our job to enforce it. On a normal day, there would be F-16s and F-15Es for ground strike, F-4Gs for suppression of SAMs, and EF-111s for radar jamming, with the Brits and French providing reconnaissance support.

By the time we leveled off, we were normally passing the tankers that had taken off 10 minutes before us. We'd lock them up with our radars and check our fire control and onboard identification systems, then start talking to AWACS.

AWACS was normally about halfway along the 50-minute, 500-mile drive from Incirlik to the border of northern Iraq. We'd pass him as he checked the systems that were tracking us and checked our Identification Friend or Foe squawks to make sure we would show up as friendly

aircraft on his scope.

As the primary air-to-air fighters in Operation Northern Watch, we were always the first into northern Iraq, sweeping west to east, making sure that no Iraqi aircraft were laying in wait in any of the mountain ranges. Once we were on station, we would call “Picture clear,” to AWACS, and the rest of the pilots in the no-fly zone enforcement package would make their way into the northern Iraq AOR—“area of responsibility.”

This was my fifth trip to Operation Northern Watch. The first few times I looked down into hostile territory and saw the patterns of surface-to-air missiles arrayed to shoot me down, I felt a jolt of excitement. Now it was just a daily grind of six- to eight-hour missions.

We were busy coordinating with the other air-to-air combat patrols over in the west part of northern Iraq when the first signs of trouble emerged.

“Weasel 2, SA-3 active, bull’s eye 030/10.”

One of the F-4G Wild Weasel jets tasked to perform SAM suppression for the coalition aircraft had picked up an active SA-3 tracking radar near the city of Mosul, about 10 miles north of the 36th parallel. Since the end of the Gulf War, the 36th parallel was the southern extent of

our northern no-fly zone. This required some serious concentration, so I put down the ham-and-cheese sandwich I had just taken out.

We’d had Iraqi radars go active a few times in the last few weeks. Intelligence thought the Iraqis might be testing new radar components they had been working with to upgrade their older Soviet SAM systems.

As with every other occurrence, about a minute later, the Weasel called “SA-3 down.” We all returned to complacency and I broke out my sandwich again. We refueled about every hour and were coming up on our fourth refueling of the day.

Suddenly, another voice came across the radio. Because of its high pitch, I did not recognize it at first as my wingman, who was flying in a two-mile line abreast formation, but I could tell it was serious.

“Mud launch, right 3!”

There it was, out the right side of my bubble canopy. In various briefs, we had been shown videos of different SAM



F-15s: TED CARLSON/FOTODYNAMICS



launches so we would recognize what one looked like. I thought I had a pretty good idea of what to expect. But when I saw the smoke trail emanating from the Iraqi desert, I flashed back to the space shuttle launch I had seen at Kennedy Space Center years earlier.

After chucking my sandwich for good, I reached down and pushed my combat jettison button to blow off the two external wing tanks. In the face of a SAM launch, our plan, which we briefed every day, was to first jettison our wing tanks to get better maneuverability to avoid the missile. If it later appeared that the SAM was tracking one of our aircraft, we would jettison a third tank, the one on the centerline of the jet, for last-ditch maneuvers.

As I watched the SAM begin to climb, it was apparent that it was not guiding on our two aircraft. If you could see movement along your canopy as you watched the missile, it wasn't going to hit you. An object on a collision course, be it a SAM, another jet, or even a car, will have no apparent movement relative to you. My mind began to slow down a little and I began remembering critical things we needed to do.

"Rambo 1, naked."

This call told my wingman that my radar-warning receiver was not showing any radars, air-to-air, or surface-to-air, tracking my aircraft. Since systems do fail, there was no guarantee that the shot was not launched at us, but it was much more reassuring than calling "Mud spike, SA-3," meaning I was being tracked.

"Rambo 2, naked."

Good. My wingman was not the target of the launch either.

"Magnum, magnum, SA-3, Mosul."

The Wild Weasels were firing radar homing HARMs—high-speed anti-radiation missiles. According to Intel debriefs of past engagements, this was often enough to make the Iraqi radar site shut down. The Iraqis often monitored our frequencies and knew that "Magnum" meant a HARM had been fired. Late in the Gulf War, a common tactic among pilots was to call "Magnum" over the radio when a SAM radar locked them up, and the Iraqis would quickly shut the site down. There were reports that even B-52s and unarmed reconnaissance aircraft had used this technique.

Today, though, the Magnum call had been for real. We saw the contrails of the HARMs arcing across the sky above us until the rocket motors burned out and the missiles started their descent at Mach 3.

We were too busy tracking the airborne SAM to be able to follow the HARMs to impact, but reconnaissance later showed that they had taken out the

tracking radar. Now the real show would begin. Though the HARMs had taken out the radar, our policy at the time was to take out the associated missiles as well.

"Sting, Duke, cleared in hot."

Duke, the commander in the AWACS, had just authorized Sting, a flight of two F-16Cs, to roll in and attack the missile site with cluster bombs. We wanted to get over to the launch area to watch the strike, but we had been briefed by Intel that a SAM launch could be a diversion for some kind of Iraqi air-to-air action. We couldn't let our guard down.

As we continued to sweep our radars downrange, looking for anyone trying to sneak across the 36th parallel, we could hear the F-16s rolling in. Both of the



pilots were from our home base in Germany and we figured they must be having fun.

That opinion quickly changed when we heard the F-16 lead call the AWACS.

"Duke, Sting, not sure we got it. Recommend re-attack."

We felt for the F-16 pilots. Nothing was more embarrassing than to miss with everybody watching. Their painful admission, however, allowed us to re-attack while the area of responsibility was still hot.

"Panther, Duke. Your turn. Cleared in hot."

The airborne commander had just called in F-15Es, the two-seat strike model, to roll in with their 2,000-pound "crowd pleasers." This was going to be spectacular.

"Duke, Rambo, we're going to reposition closer to Panther for a better look downrange."

"Cleared."

We moved about 15 miles to the west and were about five miles away as the F-15Es began their strike runs. Using laser-guided 2,000-pound bombs, it really wasn't a matter of *if* they were going to hit the target, it was which window of the truck they wanted to guide the bombs through.

As the F-15Es pulled off target, we saw the bombs hit the missile site. While the remaining missiles on the SAM site cooked off, a black mushroom cloud billowed 5,000 feet.

"Duke, Panther, good secondaries."

"Copy, Panther. Good work."

We stayed on station for a few minutes longer as British Jaguar reconnaissance jets overflew the site and snapped some pictures. Then it was time to start the whole elephant walk of getting all 30 aircraft out of the AOR in an orderly fashion.

As I taxied into our hardened shelter at Incirlik, I looked down at the floorboard of my jet. I had one last call to make to operations.

"Ops, Rambo 1. Bring out some cleaning stuff. I've got ham-and-cheese sandwich all over the cockpit."

"Rambo, ops, we'll scramble the cleaners."

That night at our tent city bar, everyone recounted their heroics. The F-16s accused us of trying to take out the SAM site by dropping our wing tanks on it and offered to give us lessons in bombing techniques.

This bought a quick response from the F-15Es, who came to our defense, thanking the F-16s for using their errant bombs to bracket the target so well that the F-15s had no trouble identifying it.

The F-4G pilots offered a theory that the Iraqis were trying to put a swimming pool in the area and figured that U.S. 2,000-pound bombs were the most effective way to dig the hole. The Intel officer described how the SAM operator would be all decked out in track clothes ready to push the button and then try to set a world record in the 400-meter "HARM evasion" event.

Finally, I received the final award of the night, from the Brit Jaguar pilots. Thankfully, there were no casualties, they said, so there would be no Purple Hearts awarded. But a little-known instance of collateral damage from the battle over Iraq had been the catastrophic failure of my sandwich, to which one Brit pilot added, "Oh, the humanity." I was promptly awarded a pink heart, for incredible self-sacrifice in the face of enemy action.

—Russell Gregory



# Adventures in Pararescue

ome years back, at the end of a low-level training flight in marginal weather, my flight of two Navy TA-4J Skyhawks landed at Naval Air Facility El Centro in California and encountered a microburst from a nearby thunderstorm. The wind proved too much for the little jets, and following a long, sideways skid, both came to rest just off the north side of the runway.

As I climbed down into the slick, sticky desert mud, I noticed, not 30 yards away, the lead A-4 lying on its side in a concrete drainage ditch. I stood in the deepening quagmire and squinted through raindrops the size of Ping-Pong balls, certain that something bad had happened to the other student and his instructor. Then the student walked around the nose of his jet, scowled, ripped his helmet from his head, and slammed it down on the ground. I hardly noticed. I was just glad he was okay.

As I stared at the upturned belly of the lead jet, a hand grabbed my elbow and nearly jerked me off my feet. Over the loud popping sound of rain pelting my helmet, I vaguely heard my instructor telling me to look out. A huge yellow fire truck, lights flashing and twirling, lurched to a stop on the spot where I had been standing. The crash crew climbed out and, finding no fire, went to work trying to rescue the other pilots, who were stranded on the far side of the flooded drainage ditch.

While they worked, an ambulance pulled up. The back doors flew open and two corpsmen jumped to the ground. They ran at us carrying what looked like the large white flotation belts water skiers wear around their waists. The first corpsman pointed at me and shouted, "Sir, lie down on the ground right now!" He was so emphatic that had I not been standing in several inches of mud, I might have obliged. Instead, I looked at my instructor, who, with his experience and flight time, surely would know what

to do. He stared back, every bit as confused as I was.

The corpsmen continued to shout and run at us with those big white things. When they showed no signs of slowing, we backed away, then jogged, then finally turned and ran in the opposite direction. Since we were still wearing our bulky flight gear and G-suits, the corpsmen easily caught up to us.

We spent a few minutes wrestling with them as they tried to put the large white neck braces on us. The corpsmen had been given orders to strap us down under the assumption that we had ejected and might have spinal compression fractures or some such injury. Eventually, we convinced them that we had indeed climbed to the ground normally.

The firemen bridged the ditch with their ladders so the other pilots could crawl across. While this process kept almost everyone occupied, I noticed one of the younger members of the crash crew sneaking off behind the fire truck. Thinking he was unseen, the fireman tiptoed some 20 yards into the desert. There, he took a quick look around and picked up a large runway sign that we had apparently knocked from its stand and sent flying into the bushes when we slid off the pavement. After another quick glance, he carried the sign back to the truck and hid his souvenir.

Before I could say anything, I heard someone calling me. I turned and saw an official Navy car parked beside the ambulance. A Navy captain, wearing a leather flight jacket, motioned

surreptitiously for me to come over.

I approached the captain, feeling weak-kneed at the thought that I must be in big trouble. He asked where my skipper was and if I knew what we planned to do with the A-4 in the ditch. I told him I thought we would probably just tow it out and fix it, but that I was just a student and really did not know. He looked wistfully through the pouring rain at the overturned jet. He said that just about every aircraft that the Blue Angels had ever flown was on display at the base's front gate except an A-4, and that our jet would look really good there with a blue and gold paint job.

When everyone had been rescued from the drainage ditch, we climbed into the back of the ambulance for our ride to Medical. I noticed the other student staring at a huge ball of brown mud in his lap and realized that this object was his helmet, which he had thrown down earlier. I asked him why on earth he had done such a thing. He looked up at me as if the answer was obvious, and in a slow, Southern drawl told me that that was "what NASCAR drivers do when they crash on TV."

In Medical, we were poked, prodded, and examined. We relaxed, knowing that no one was injured and aircraft damage was light. The A-4 in the ditch was towed out, repaired, and flown again. During takeoff on its first flight back, it sucked a bird into its engine and skidded to a stop just off the far end of the runway. From then on, no superstitious pilot would go near the cursed airplane.

—Will Oliver



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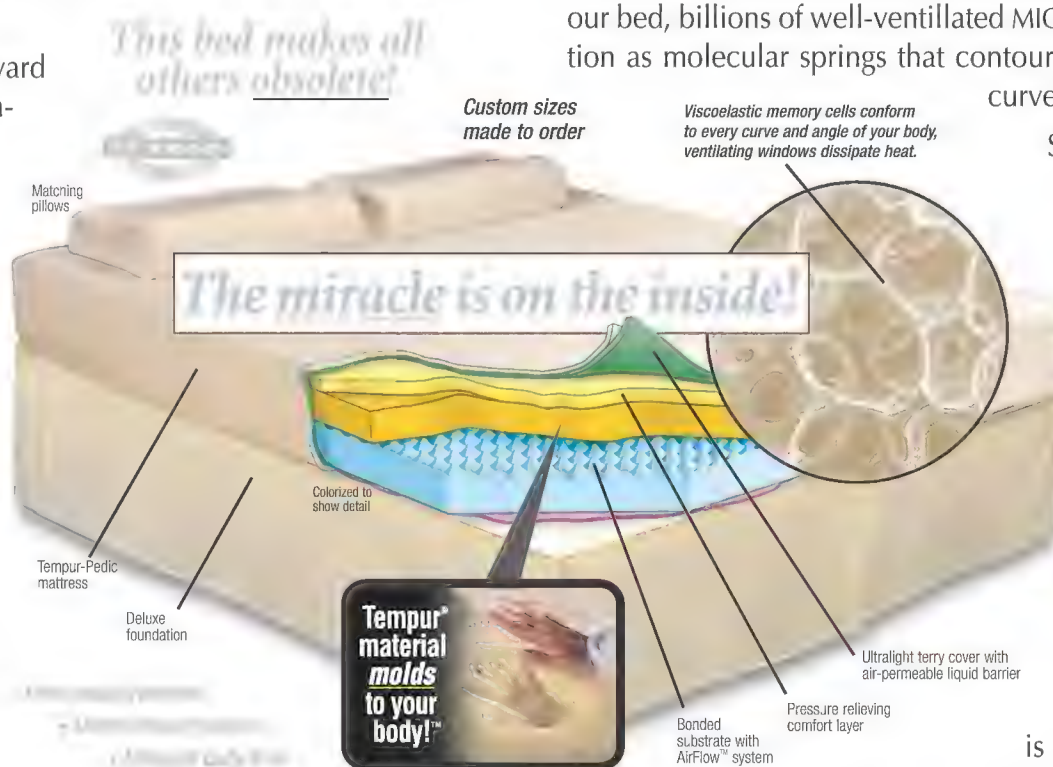
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# the CONCORDE

A Concorde Prototype 001 swiftly accelerated and rotated off the runway at Toulouse-Montaudou airfield, an odd scene was taking place just outside the perimeter fence: Many in the crowd were not just watching the Concorde's maiden flight, they were cheering "Allez France! Allez France!" as if they were watching France score a goal in an international soccer game. When the airplane landed 35 minutes later after a subsonic flight, it was clear not only that aviation history had been made on March 2, 1969, but also that France had a proud new symbol. As the Paris newspaper *Le Monde* once noted, Concorde "was created largely to serve the prestige of France. [It was] the expression of political will, founded on a certain idea of national grandeur."

Thus the national trauma that gripped France last summer. At 4:44 p.m. Paris time on July 25, 2000, with pilot Christian Marty and copilot Jean Marcot at the controls, Air France Flight 4590 blew a tire on its left main gear on takeoff from Charles de Gaulle airport. As the crew fought to keep the airplane under control, it began drifting left on Runway 26R with a long sheet of flames trailing from its left wing. The alarm gong sounded in the cockpit, and engines one and two, of four, lost power. "Watch the airspeed, the airspeed, the airspeed!" Marcot yelled to Marty as the airplane continued heading left, in the general direction of a taxiing Air France 747 bringing President Jacques Chirac back from a summit in Tokyo.

Marty tugged on the controls and tried for liftoff at 188 knots, 11 knots

CAN THE SUPERPLANE MAKE A COMEBACK? V







# WORLD Redemption

BY JOSEPH HARRISS | PHOTOGRAPHS BY ETIENNE DE MALGLAIVE

*Though grounded after the July 25, 2000 crash, the 13 Concorde previously in service are kept nearly flight-ready. Here, an Air France mechanic at Charles de Gaulle airport in Paris checks a pitot tube for obstructions.*



below normal rotation speed. With thrust coming from only its two right engines, Flight 4590 struggled barely 200 feet into the air, then suddenly went nose up, rolled over, and crashed onto a hotel. All 100 passengers, mainly German tourists heading for a rendezvous with a cruise ship in New York, were killed, along with the three flight crew members, six flight attendants, and four people on the ground.

Said France's largest newspaper, *Le Figaro*, "Without doubt, Concorde died yesterday at the age of 31. All that will remain is the myth of a beautiful white bird." Comparing the crash to the sinking of the *Titanic*, the *Hindenburg* bursting into flames, and the *Challenger* space shuttle exploding, London's *The Times* lamented, "Nothing will ever be quite the same again.... This was the superplane, the symbol of progress, the icon of invention, a totem."

Air France president Jean-Cyril Spinetta, standing in his office by a picture window overlooking Charles de Gaulle's runways, watched, horrified, as Concorde F-BTSC trailed flames and crashed. He immediately grounded the company's Concorde fleet until further notice.

Like many, Spinetta thought he knew what went wrong. "For all of those who were eyewitnesses to this catastrophe, and I am one of them," he said later, "the cause was an engine fire on takeoff." But was it?

British Airways initially followed Air France's lead and grounded its Concorde, then resumed service the next day. But the French company heeded Transport Minister Jean-Claude Gayssot, who declared that the airplane would not fly again until the accident was fully explained. Franco-British discord continued until August 16, when France's Bureau Enquêtes Accidents (BEA) declared that, contrary to Spinetta's impression, a tire blowout caused the crash.

It also took the rare step of recommending suspension of

Concorde's certificate of airworthiness. France's Direction Générale de l'Aviation Civile (DGAC), the equivalent of the U.S. Federal Aviation Administration, pulled the certificate, and Britain's Civil Aviation Authority went along. CAA Chairman Sir Malcolm Field explained: "What is uniquely different in this case is that tire debris alone is thought to have led to this catastrophic accident." With that, BA stopped one Concorde as it was about to take off from Heathrow, and ferried another back from New York without passengers.

Two official French inquiries were set in motion. The BEA searched for causes, while a judicial investigation headed by three magistrates tried to determine legal responsibilities. As the investigation dragged on for months, Britain's Air Accidents Investigation Branch, which participated in the inquiry under terms of a long-standing Franco-British agreement on Concorde safety incidents and was eager to keep the investigation moving, officially protested against

"unacceptable procedural delays" in France, to no avail.

The first puzzle to solve was a piece of the number five fuel tank found on the runway that somehow had been torn loose from the inside out. Researchers from European Aeronautic Defense and Space Co. (EADS), successor to the original French Concorde builder, Sud-Aviation, ran a computer simulation that came up with the answer: When a large piece of tire weighing about nine pounds struck the underside of the left wing, the impact generated a shock wave, propagated through the full tank of jet fuel, that moved first up, then down, exploding outward. The resulting one-square-foot hole created a massive kerosene leak—on the order of 20 gallons per second—that somehow ignited.

Why was there such a large chunk of tire, bigger than usual, after a blowout? Investigators found a 17-inch piece of titanium on the runway, a thrust reverser wear strip from

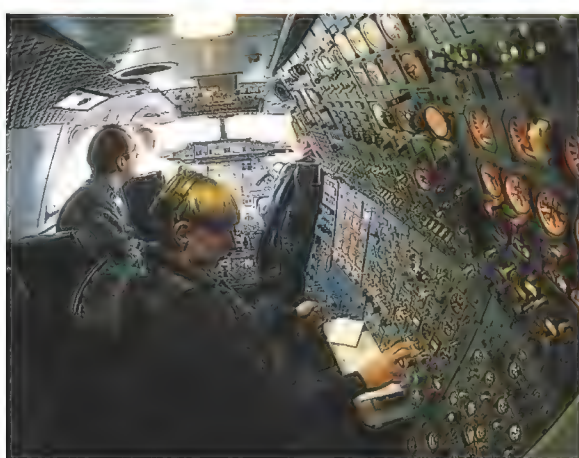


*Ending a 24-year run without a fatal accident, the crash killed 113 (top). Mechanics clean up after an engine run last December, intended to keep the Olympus 593s in top shape (above). In happier times, Concorde taxis at de Gaulle (opposite).*









*A Concorde awaits safety modifications (above). During an engine run, the flight engineer adjusts fuel loads, a critical balancing function in flight (left).*

an airliner that had taken off minutes before Flight 4590. Striking it at high speed, they theorize, the number two tire was scalped of a five-foot length of tread, which was whipped up at the wing by tremendous centrifugal force, producing the shock wave.

But the most controversial finding concerned a spacer that normally holds two lateral rings in position on the oleo/bogie coupling of the left main gear and is vital to wheel alignment. Apparently because of an Air France maintenance error, the spacer was not reinstalled after routine maintenance work performed four days before the crash, the BEA preliminary report says. Nonetheless, the BEA ruled out the missing spacer as a cause of the crash. (Air France, which sources close to the investigation say has been “traumatized” by the crash, and which was sued for some \$100 million by families of the crash victims, declined repeated interview requests for this article.)

“The truth is that because of that missing spacer, the left main gear was slightly skewed on the takeoff roll. Skidding heated and wore down the tire, caused the plane to drift to the left side of the runway, and kept it from accelerating normally,” charges Jean-Marie Chauve, a 37-year Air France veteran and retired Concorde pilot who has done his own calculations—and had them verified by independent experts—based on published information from the flight data and cockpit voice recorders. His version is seconded by Michel Suaud, a longtime Concorde flight engineer who is now retired. They spent several months preparing a detailed report on the crash, which they have presented to the investigating magistrate of the judicial inquiry.

“Our figures show that the plane was moving to the left at the start of the takeoff roll, not just after the blowout and loss of engines one and two,” Chauve says. “The tire burst at around 174 knots and only *after* the blowout did it strike the metal strip. If acceleration had been nominal, the plane would have been airborne about 50 yards before reaching the strip. The BEA says the leftward yaw was caused by loss of thrust from the left engines, not by the skewed bogie. But they’ve never shown us where our figures are wrong. They are under pressure to make this look like a freak accident caused by that piece of metal on the runway. That would cover up Air France’s fault in letting a plane take off that wasn’t ready.”

Asked about this, BEA chief Paul-Louis Arslanian responded: “It’s true that, due to a regrettable maintenance error, the spacer had not been replaced. But our investigation shows that its absence, though it slightly affected alignment of the left gear, had no influence on the way the tires were worn, or on the plane’s trajectory and acceleration.”

The argument may never be settled to everyone’s satisfaction. Meanwhile, the DGAC and CAA called in the original Concorde builders, BAE Systems, successor to British Aircraft Corporation, and EADS Airbus, along with the original Olympus engine manufacturers, Rolls-Royce and Snecma. If Concorde were to fly again, they would have to keep that kind of accident from happening. (French and British regulations do not require waiting for results of the investigation to begin modifications, or even for the airlines to resume service.) Says Gérard Le Houx, a DGAC official in Paris: “We told them there are three general problem areas: reinforcing the plane’s structure, mainly the fuel tanks, preventing such a fire, and ensuring the engines are not affected by fire when there’s a fuel leak. Once they give us those solutions, we can consider restoring Concorde’s certificate.”

With the airlines pushing to resume service, the companies assigned some 100





engineers to the top-priority project. "At first we and EADS Airbus talked with the authorities about all sorts of modifications, feeling our way, pushing forward on a number of fronts," says Howard Berry, an official at BAE Systems. "What we had to do was somehow break the chain of events that occurred in the crash. The time scale [for completing the modifications] has been unpredictable because we've been going down a number of avenues and have to take into account any test results and the accident investigation."

Besides the technical challenge, there was an economic one: The modifications must not unduly increase the airplane's empty weight or reduce payload or maximum range, any of which would make it more costly to operate. And time was of the essence: Every month the Concorde fleets were grounded cost the two operators millions of dollars in lost revenue, continuing maintenance, salaries for inactive air crews, and, possibly, long-term loss of passengers.

From the start, British Airways was more optimistic about

*Crash investigators focused on the left main landing gear. A piece of tire had struck the wing, puncturing a fuel tank.*







EADS AIRBUS

*Last January, EADS Airbus conducted a test with yellow-colored water to see how air currents would affect a fuel leak when the Concorde was taxied at high speed.*

getting Concorde back into service than Air France. “That’s normal,” says Claud Freeman, BA Concorde manager at London’s Heathrow Airport. “After all, Air France management saw it happen right in front of their offices. Had we not taken a very positive attitude immediately, I believe Concorde probably would have stopped flying for good.”

The engineers felt the pressure; they were not only modifying an aircraft but trying to save an icon, a super-sleek machine that travels at Mach 2, faster than a rifle bullet. The roughly 150,000 Concorde passengers a year have gladly paid some \$10,000 for a round-trip transatlantic ticket to race the sun, leaving London or Paris for New York and arriving a few minutes before they left (fastest crossing on record: two hours, 52 minutes, 59 seconds in February 1996, New York to London). As BBC interviewer Sir David Frost, who has made over 200 trips on the airplane, has said, “Concorde is the only way I know that you can be in two places at the same time.”

Not bad for an aircraft designed when engineers still used slide rules and log tables to figure out supersonic aerodynamics. Concorde’s engineers created a radically different bird that operates in a weird environment. At Mach 2, about 1,322 mph, and 60,000 feet, the air temperature is around –67 degrees Fahrenheit, but atmospheric friction heats the fuselage skin to the boiling point of water, expanding the metal and making the airplane about half a foot longer. “Concorde is a triumph of engineering,” says John Anderson, a curator in the aeronautics division of the National Air and Space Museum. “Particularly the wing, which is very complex in shape with lots of curvature for low drag and good stability. And they did it all without computers.”

Today, however, its flight deck instrumentation is old technology, the equivalent of a first-generation 747. Concorde pilots laboriously read electro-mechanical dials instead of glancing at the comprehensive, computer-generated displays of contemporary glass cockpits. “It’s not an easy plane to fly. You have to be constantly alert,” says Peter Duffey, a retired British Airways Concorde pilot and author of *Comets and Concordes*. “Things happen more quickly. For example, its takeoff time is only half that of a 747. At Mach 2, about 22 miles a minute, you’re always thinking about where you can land in an emergency, and there are about 50 reasons besides engine failure why you would have to take it down to subsonic flight. Unlike a conventional transatlantic run, you’re not sitting there for seven hours

wondering what to do with yourself.”

Its makers never got around to modernizing Concorde’s cockpit because not enough were sold to make updating it economical. After the French and British governments sank several billion dollars in development costs in the 1960s, the only takers were their two captive, state-owned national carriers. As early as 1965, Beverly Shenstone, the technical director of BOAC, the predecessor of today’s British Airways, warned that Concorde was “the largest, most expensive, and most dubious project ever undertaken in the development of civil aircraft.”

Only 20 Concordes were built, including prototypes and pre-production models; 14 entered service. Because Concorde’s development costs were footed by taxpayers, both British Airways and Air France have claimed in recent years that their supersonic flagship was making a slim profit—in Air France’s case, reportedly only about \$3 million, or a minuscule 1.3 percent of its total annual profits. “The eco-





nomics of Concorde never made sense and there was never a market for it," contends Ron Davies, curator of air transport at the National Air and Space Museum. "For every hour it spends in the air, it spends 14 on the ground. And for every seat transported across the Atlantic, it has to carry one ton of fuel—two tons if it's only half full, which often happens. It's so inefficient it's unbelievable." And all that development money spent? "Taxpayer-funded executive air transport," Davies says. "It's one of the biggest scams ever perpetrated. Concorde's days are numbered and all they're doing now is prolonging the agony."

*Safety modifications require workers to enter the labyrinth of fuel tanks inside the enormous wings and insert custom-fitted Kevlar liners.*

Last year's crash shocked the world. Yet the omens had long indicated that not all was well with the beautiful white bird. The very day before the crash, Air France discovered cracks in the wings of four of its six aging Concorde (though not in the one that crashed). This followed British Airways' finding cracks, like those at Air France, termed non-safety-critical, in all seven of its airplanes; it grounded one for repairs just before July 25.

Perhaps more ominous is the long series of incidents and warnings that came to light as crash investigators and the media delved into Concorde's past. For example, aircraft be-

longing to both companies had lost parts of their elevons and rudders several times in flight but were able to land safely. In 1998, the Olympus 593 engines were found to have 152 problems in hardware design or other factors, 55 of which were considered "significant risks," and BA and Rolls-Royce initiated a plan to remedy them. The engine study warned, "A major technical event would probably end Concorde operation."

But the scariest scenario to come out this year has been the BEA's list of 57 tire-related incidents from 1976 to 2000, 30 of which were on Air France flights and 27 on British Airways. Of those, 32 blowouts damaged the aircraft's structure, engines, or hydraulics, and six resulted in penetration of one or more fuel tanks.

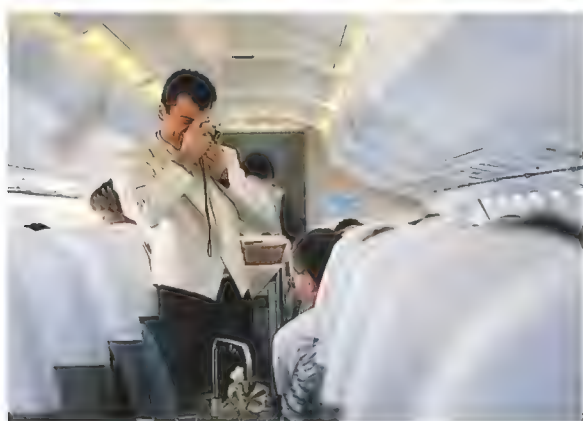
The worst of these occurred on June 14, 1979, when Air France Flight 054 to Paris blew the two rear tires on its left main gear on takeoff from Washington Dulles Airport, hurling high-speed rubber and wheel rim debris at the left wing and engines. The flight crew knew about the blown tires and were diverting to New York, but they were unaware of the true extent of the problem until a passenger







*British Airways has been more upbeat about the Concorde's future, but is following Air France's lead.*



*A flight in the Concorde was not just a trip but an event—passengers frequently ask flight attendants to take their pictures. Will it fly again?*

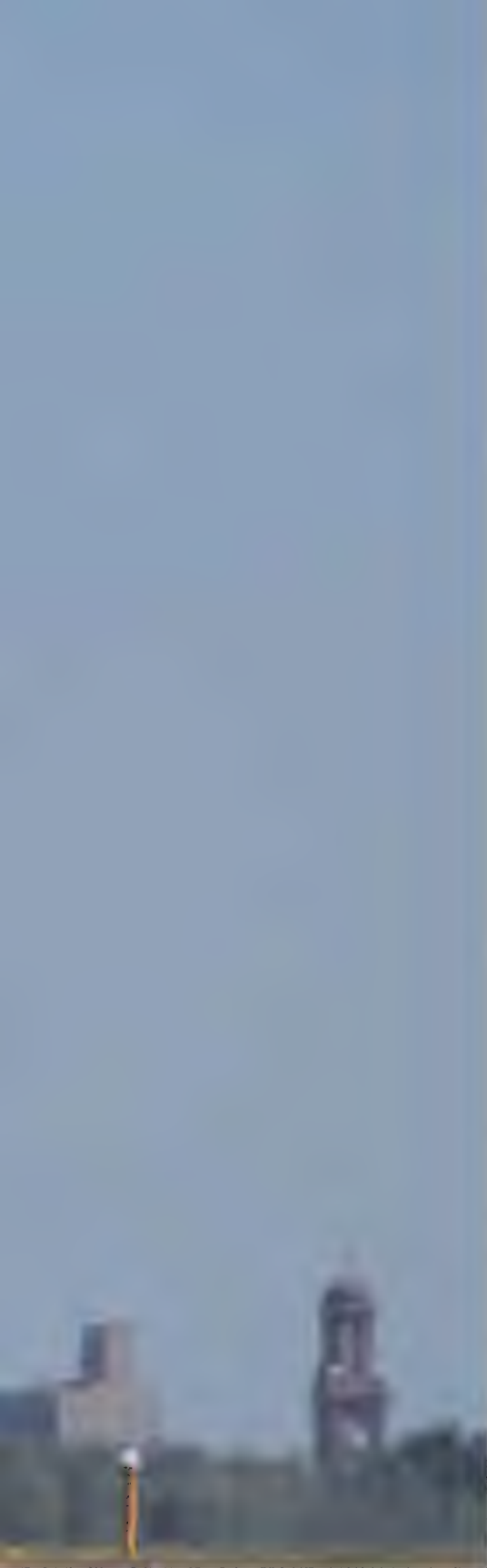
convinced the mostly indifferent cabin attendants to bring a crew member back to examine a 12-square-foot hole in the top wing skin. "I took the gentleman who had come back from the flight deck to my seat and virtually held his head to the window so that he could look down and see the hole in the wing," the passenger wrote in his harrowing statement to the National Transportation Safety Board (available at [www.airspacemag.com](http://www.airspacemag.com)). "When he saw the hole,

he exclaimed, 'Mon Dieu!' " The crew managed an emergency landing at Dulles with Jet A1 streaming from a dozen holes in fuel tanks, damage to the number two engine, severed electrical cables, and the loss of two of three hydraulic systems. Following recommendations from the NTSB, the FAA urgently telegraphed airworthiness directives to both Concorde operators detailing procedures for more intensive checks of tires, wheels, and brakes.

The airplane was later modified to include roll-on wheel rims, strengthened tires, and a tire failure warning in the cockpit. But even after the NTSB's then-chairman, James B. King, wrote to his French counterpart on November 9, 1981, expressing "serious concern" about "the repetitive nature of these incidents," they continued. As another former NTSB chief, Jim Burnett, points out, "Concorde could have been certified with a design flaw nobody noticed at the time. If there were as many Concorde flying as 737s, I suspect that we would have seen this kind of accident many times."

Will the current modifications solve the problem for good? Because EADS Airbus is responsible for the wings, it has





RUSSELL MUNSON

taken the lead in trying to find the solution. Its engineers quickly focused on modifications to the fuel tanks to cut the risk of fire from a fuel leak, and armoring electrical cables, which were suspected of igniting the fire with a spark, in the airplane's wheel wells.

Armoring the wiring was the easy part. It was shaped into "looms" of 15 to 20 cables each, the main one going to the brake cooling fans. These were then protected with braided stainless steel and Teflon, rather than the aluminum tubing used before. To protect the fuel tanks, engineers decided on flexible liners of Viton, a heat-resistant rubberized sealant, and Kevlar, a material used in bulletproof vests. Five times stronger on a weight basis than steel, the thin sheets of Kevlar are sandwiched between layers of Viton. The liners, the reasoning goes, will reduce any shock wave that would be produced by debris and limit

it the flow of fuel by being sucked down into a hole.

Still, this sort of modification has never been tried before on an airliner. If the theory is simple, the execution is enormously complex. "The liners are actually in the form of 102 shallow trays that go into six fuel tanks, depending on their proximity to the wheels," explains Claud Freeman, working at the Heathrow hangar on Alpha Foxtrot, the first Concorde to receive the modifications. "Concorde was in effect hand-built, with each one slightly different, so each liner is custom molded to achieve the exact shape and size. We have to keep them separate from the wing skin, because circulating fuel keeps it cool at supersonic flight. That's why the liners' sides are attached to some 5,000 separate attachment brackets bolted to wing spars. Because the fuel can't flow as freely as before, this will create about 880 pounds of additional unusable fuel. We might have to take out a row of seats."

The modifications were done by teams of 40 engineers working two eight-hour shifts a day. "It's work for engineers on a diet," quips Denis Morris, a project manager in the Concorde division. "First they have to squeeze through these

oval access holes in the underside of the wing, then crawl through the inside of the wing all the way out to the end, where there's only barely enough space to work."

Although not strictly part of the airplane's recertification efforts, new tires being developed by Michelin are supposed to mitigate the blowout problem. Radial models banded with an aramid composite similar to Kevlar, they are expected to better resist bursting; if they do blow out, they should break up into smaller pieces less likely to hit the fuel tanks. They are also expected to be about 44 pounds lighter than the previous ones, meaning a total saving of 352 pounds—helping offset the weight increase due to the liners.

Can Concorde come back? "I have always said that Concorde would fly again," French Transport Minister Gaysot has declared. Media leaks in Paris had Air France laying plans for a resumption of service in September or October. British Airways, which is spending nearly \$25 million to modify the Concorde, was poised to proceed faster, assuming the CAA restored the certificate of airworthiness, and was betting a further \$20 million worth of refurbishing on the fleet's cabins, including new lighting that turns blue as Concorde hits Mach 1. (Air France hasn't released its costs, but has indicated that it has set aside \$11 million for costs related to resuming service.) Says Les Dorr, spokesman for the Federal Aviation Administration: "We would accept the certification of the CAA and the DGAC, unless there were some obvious issues that gave us reason to disagree with them or suspect the aircraft was unsafe."

*Should Concorde come back?* "If they get the modifications worked out and the certifying authorities are satisfied the plane is safe, then why not?" says Frank Taylor, director of the Aviation Safety Center at Britain's Cranfield University. "Given the relatively small number of flying hours it puts in and the great amount of maintenance attention it gets, its age should be no problem."

Former NTSB chief Jim Burnett has some doubts. "I would love to see Concorde fly again," he says. "But this accident reminds us that if it fails, a plane poses a risk not only to those flying it but also to people on the ground. All of us in aviation safety know the greatest risks are on the runway, during takeoff and landing, and that's where Concorde has had the most problems."

When the airplane entered service in 1976, its lifespan was to be 6,700 flights, which would have dictated ending operations around 1993. Since then, structural modifications, changes to inspection and maintenance programs, and other alterations have extended that to around 2010, depending on usage. But Concorde's comeback is not just a question of technology. Just as there were 30 years ago, intangibles like prestige are at stake. And it's still a marketing tool in a very competitive arena. As Rod Eddington, British Airways chief executive, says, "It's one of the few things in this business where one airline enjoys a unique sustainable advantage over another." —





ROBERT A. FLISCHEL

# THE REUNION

**A World War II bomber pilot, his fighter escort, and one whopper of a coincidence.**

*by John Fleischman*

**H**erb Heilbrun keeps everything. He has every canceled check he ever wrote. He has the manufacturer's manual for the B-17G he picked up at the Boeing factory in Seattle on October 12, 1944, and the flight log that records the 7,075 miles and 41 hours of his flight from Lincoln, Nebraska, to Foggia, Italy, via Newfoundland, the Azores, and North Africa. He has one of the 89 chunks of shrapnel that ventilated his bomber on Christmas Day 1944, while his squadron was attacking refineries at Brux, Czechoslovakia. He has the government-issue rubber oxygen mask and canvas flier's helmet that he wore 30,000 feet over Brux. And he has the

diary he kept to detail his 262 hours in combat, piloting a B-17G from Italy up the Adriatic, over the Alps, and into the industrial heart of Nazi Germany. He knows to the minute how long he was in combat and on what dates he flew against which targets.

In 1995, Herb read in the Cincinnati paper that the city was honoring the local chapter of the Tuskegee Airmen. *Red tails*, Herb remembered. The Tuskegees were the all-black 332nd Fighter Group. They flew red-tail P-51s on missions escorting bomber squadrons from Italy into Germany. Herb could still remember hearing, amid the radio chatter over the target, the distinctive voices of the Tuskegee Airmen. He felt

that his thanks were overdue.

"The mayor was making a presentation on Fountain Square," Herb recalls. "I went down to the hotel where they were having some sort of reception and I told somebody that I flew B-17s in Italy and that the Tuskegee Airmen escorted me. I said that if there's a flier around here that was over there, I'd like to give him a hug for saving my behind. Then someone said, 'There's

*After they reunited, John Leahr (above, right) enlisted Herb Heilbrun in his ongoing campaign to make sure everyone, from schoolkids to the elderly, hears the story of the Tuskegee Airmen.*



a fellow over there. I think he did that.’ ”

The man was named John Leahr. When the two were introduced, Herb hugged John and said: “I’ve been waiting 50 years to meet one of you guys. You saved my tail on many a day.”

The black ex-fighter pilot and the white ex-bomber pilot became friends. They went out for lunch.

They visited each other’s homes for dinner. They began matching up dates and other details of combat missions they’d flown. John had indeed flown cover on at least two of Herb’s 35 missions: Brux on December 16th and Blechemmer on December 17th. Brux on the 16th was bad but not as bad as Brux on the 25th, Herb recalled. On that mission—Christmas Day—his fuel tanks were hit, his high-altitude oxygen system was hit, and his armor gunner ended up getting wounded in the foot.

As the two got to know each other, they discovered other things in common. The men had been born within a mile of each other, and only seven months apart. Both had come up through Cincinnati public schools, and both had managed to scrape together two years of college during the Depression. Both had enlisted in the Air Corps within weeks of Pearl Harbor. Both had to wait months to be called for flying school, so both took jobs at the same airplane engine factory: Wright Aeronautical in Lockland, Ohio. Herb tested engines, firing up GR-2600-655 Cyclones on test stands. John worked in the plant foundry. The work was filthy, hot, and done exclusively by blacks, he recalls.

Herb got assigned to Italy as part of the 32nd Squadron of the 301st Bomb Group. He arrived well schooled in the elaborate squadron takeoff ritual that quickly launched and stacked dozens of bombers into box formations. Rising from fields all around Foggia, the bomber echelons assembled themselves until hundreds of aircraft were swarming up the Adriatic. The first time Herb saw one of the enormous boxes, it took his breath away.

A few thousand feet above the B-17s and off to the side, John Leahr flew escort in a P-51. “I’d always wanted to fly,” he recalls. “It fascinated me, but I’d never been up in an airplane in my life.” Word that the corps had been forced to train blacks as pilots electrified the black community, John recalls, and he rushed to join the War Department’s pre-war Civilian Pilot Training program. The CPT assigned black pilots to get their primary training at the Tuskegee Institute in Alabama. Traveling to the deep south in that era “scared me to death,” John recalls. “There were so many stories. At that time, there was no federal anti-lynch law, and black people were beaten up and killed and nothing was done about it.”

The Air Corps wanted only enough black pilots to fill a handful of token squadrons, so the washout rate at Tuskegee was ferocious. John’s flying career almost crashed on takeoff. “It was when I was ready to solo,” he recalls. “I was lined up to take off and I thought I’d cleared myself good. So I started down the field and then I heard a strange noise and I looked up. Here’s an airplane coming right down straight on top of me.... My prop hit the tail wheel of this other airplane and made a nice clanking noise.

“My instructor was way down on the other end of the field. I didn’t think he knew what’d happened. I thought that if I didn’t get this airplane off the ground now, I would probably never fly. If you hit another airplane, why that’s a washout. So I took the plane off without checking the prop. And that plane tried to slow roll on me all the way around the field. I got it up in the air, holding full rudder and stick to keep that plane straight.”

After a brief flight, John managed to land. “The instructor came running

up shouting, ‘Did you hit that other airplane?’ “I played dumb and said, ‘I don’t think so’.... He told me the commanding officer wanted to see me. I knew what that meant. I was going to be washed out.

“I reported in the finest military manner, and he was sitting there ignoring me for a while and then suddenly he’s roaring at me, ‘You darn near killed an instructor and another student!’ and so on and so forth. He gave me a good chewing out. Then he said, ‘Go on and get out of here and be more careful.’ Man, was I happy.” In July 1943, John earned his wings.

The following February, his squadron landed in Italy. The black airmen lived apart from the white Air Corps. “The whole crew, everyone—mechanics, cooks, squadron commander, everybody—we were completely segregated,” says John. The pilots flew hand-me-down aircraft. When John’s squadron first went into combat with the 12th Tactical Air Force in February 1944, they were the only Americans in Europe flying the cranky and obsolete P-39 Airacobra. That July, the squadron was given weary P-51Bs and -Cs left them by white squadrons trading up to the more advanced P-51Ds.

On a mission, the bombers would be about two hours out when the fighter escorts caught up with them. On the intercom of his B-17, Herb could hear his gunners sight them, high above the box, cutting S turns to eat up the difference in ground speed between bombers and fighters. The escorts were supposed to handle enemy interceptors, but nothing seemed to lessen the flak. The Germans moved mobile

flak units around to surprise the Allies while they were crossing the Po Valley or near the mountain passes that they followed into Austria and Germany. And once the bombers reached their target, all the anti-aircraft guns on earth seemed to be waiting for them, altitude fuses set. It was the engineer’s job to dress the pilot for the bomb run—helmet and a heavy flak jacket shaped like an umpire’s chest protector. Herb



COURTESY JOHN LEAHR

*John Leahr,  
332nd Fighter  
Group*



COURTESY HERB HEILBRUN

*Herb Heilbrun,  
301st Bomb  
Group*



would tuck the tail between his legs, then continue on with his squadron toward the target.

"You'd see those poor bomber boys line up and go straight into that flak," John says. "It would be a beautiful clear day and you'd look up into a blue sky, it would be beautiful. But when those bombers would line up, it would look like one hell of a thunderstorm where that flak would come up bursting. And those bombers would fly right through it.

"We watched those guys go through hell. We're sitting out on the side waiting for them to come out and we could see them getting hit. If they got hit in the bomb bay, the plane just exploded into a great big ball of fire. The whole plane blew up and then it was nothing.

"When they came off target, that's when the enemy fighters used to really get them. These guys would come off the target all shot up. Maybe they'd have a couple of engines knocked out. Maybe on fire. That's when we would try to pick them up. They'd call us 'Little Friend'—'Little Friend, I'm going down.' Or 'Little Friend, I'm losing altitude. Can you see us? The pilot's dead. Or the copilot's injured. Stay with us. Little Friend, stay with us.' That's when those enemy fighters would come to shoot those poor guys down like sitting ducks.

"Sometimes they could get the plane together and get away from the target. Some might crash-land it if they could find a good place or some would bail out all together safely. In some instances, we were able to escort them far enough from the target so that they could make it on back. We would be running out of gas. We knew to the minute how long we had before we wouldn't make it back ourselves. The stragglers would be very slow, traveling on two engines, but we stayed with them long enough to get them out of range of enemy fighters." The Tuskegee squadrons, John says, never lost a bomber they were escorting home.

John was eventually returned to the

States so he could get advanced training to become a flight instructor at Tuskegee. He found that the racial climate back home had not changed. He recalls an incident in Memphis, where he had been sent by the military for a goiter operation. While convalescing, he and three other black officers had gone into town, and at a bus stop were accosted by a drunk. "He was a big redneck, a thug if there ever was one," John says. "He stopped the four of us while we were waiting to transfer, right down there in the heart of town. We were in uniform. I was in full dress, with my decorations on, when this guy comes up and says: 'I'll be damned. Look at these niggers. And nigger of-



*On one mission over Brux, Czechoslovakia, Herb's B-17 took 89 shrapnel hits.*

ficers.' And then he says: 'Two of them got wings on. Damn, I've killed a lot of niggers, but I never killed any nigger officers. I'm gonna kill you niggers.' " Luckily, the intervention of a passing white sailor and the arrival of a bus allowed the officers to escape.

Once he was out of the military, John discovered that he was a pretty good salesman. He sold securities and managed a brokerage office before retiring as an office administrator from Cincinnati Gas & Electric. Herb became a salesman too, selling radio ads and then commercial real

estate. (He's still doing a deal or two.) Today, John is a widower with children and grandchildren. Herb is remarried and busy with his own children and grandchildren, as well as his step-children and step-grandchildren, plus the kids who attend his wife Carol's in-home daycare center. When their paths crossed at the Tuskegee Airmen's reception, the men were living 10 minutes apart.

One night, Herb recalls, "Johnny and I were having dinner, and he said, 'You know, I grew up in Avondale.' And that's when I said, 'So did I.' And I remember what he said: 'There were only five black families in Avondale, and I went to a school on Clinton Springs Avenue. It was an old mansion.' And I said, 'I went to that school. I lived on Warwick right where it came into Clinton Springs, and I would just walk up Warwick and right into school.' Well then he said, 'I don't remember you.' And I said, 'I don't remember you.' "

That wasn't surprising. When it came to racial matters, Cincinnati had Southern ways. During World War II, Cincinnati's railroad station had the distinction of being the southbound point where passenger segregation began. Most of Cincinnati's hotels, restaurants, and even hamburger stands were for whites only.

Still, after Herb learned that he and John had gone to the same school, he wondered if they had ever intersected. When he got home he went through his photo albums; of course he still had his second grade picture.

The photograph shows 40 kids in the class; 38 are white and two—a boy and a girl—are black. John recalls what happened next: "Herb sent [the picture] to me with a little note that said, 'John, this thing is getting crazier and crazier by the minute. If that little black guy in this picture is you, well, that kid behind him who is almost touching him is me.' " It was true.

Today, John and Herb take out the picture to show a visitor. "So that's me right there, and that's Herb right there," John says, tapping the white boy with the home-barbered bangs standing right



behind him. Their teacher is in the back row. The two agree that Miss Pitchel was a tough cookie.

"And see that black girl there?" says Herb. "I remember her name was Mary Louise Hillman, because my mother's name was Mary Louise Heilbrun."

"Herb, do you know she's still living right down the street from the school on Clinton Springs?" says John. "She's not in the same house she was living in but she's in the same neighborhood."

"Now isn't that something?" says Herb, admiring the photo again. "This was 1928. That's a few weeks ago."

For the last 25 years, John has been campaigning to tell people about the role of the Tuskegee airmen in World War II and in the country's racial history. Time is the enemy now for the Tuskegees. These are their last years to speak for themselves, putting on record not just their valor at war but the ugliness they confronted at home.

After the two reunited, John enlisted Herb in his campaign. Together, they speak at schools, clubs, and to any other group that will listen. The Kroger Company in Cincinnati had them address a corporate banquet.

Today, they are scheduled to speak at the suburban Cincinnati campus of Raymond Walters College. Herb is waiting in the driveway when John drives up. John climbs out to contemplate Herb's nearly vertical backyard that drops into a ravine. "I mowed that once a week for 30 years," says Herb. "Then I hired this kid to do it for me. I got smart."

"You got old," says John.

The two load the car with their Tuskegee Airmen displays and take off. John drives like a pilot, checking instruments, scanning the horizon, and carefully watching his tail.

Their college audience today turns out to be senior citizens enrolled in an "Institute for Learning in Retirement" course on World War II. At first it seems John and Herb will be preaching to the choir, until they observe that many taking their seats in the lecture hall seem to be only in their early 70s—too young to have gone to their war. Which is fine with John and Herb. Fresh ears are always in short supply.

Joining John and Herb today is

Leslie Edwards, a Tuskegee ground crew chief who witnessed the nearly forgotten 1945 "Freeman Field Mutiny." On a small training field near Seymour, Indiana, 162 black officers were court-martialed after refusing the base commander's order to sign a pledge that they would stay away from the whites-only officers' club. (The NAACP sent Thurgood Marshall to their defense, and though a handful of officers were convicted, General George Marshall eventually overturned the convictions.)

John begins by showing a video—a segment from a TV documentary on the Tuskegees. He talks about his training, about shipping out, and about getting jumped over Linz, Austria, by 40 German Bf 109s. Two of his wingmates were shot down at once, his flight leader was driven off, and, surrounded by enemy aircraft, he discovered that his machine guns had frozen at the high altitude and were unable to fire. He tells the audience that he owed his escape to a mixture of aerial acrobatics and applied religion.

When it's Herb's turn, he tells the audience about the bomber war. He tells them about the wooden boards in the briefing room where each crew

member's last name was posted on a metal strip; one morning Herb watched the operations officer take down a stack of strips and toss them in the trash. They were shot down, the officer explained. They're not coming back. Herb reaches into his pocket and with a grin holds up a battered metal strip with "Heilbrun" written in white. The audience claps.

He talks about his homecoming in 1945, about meeting John all those years later, and about piecing together their past. Herb puts up a projection slide of the photograph of Miss Pitchel's class. The picture never misses.

Getting to know John and hearing about the Tuskegees' war opened his eyes, he says. "He gave me a real education. I'm an honorary member of the Tuskegee Airmen, and I consider it a great honor.

"In all those missions, I was never under fighter attack," he says. "If it weren't for men like John Leahr, I wouldn't be here. So that's one reason I like John Leahr. Actually that's the main reason I like John Leahr." They hug. The audience laughs.

One arm around John, Herb says that the two have one request. "Don't forget us," he says. ➔

*Do parallel lives ever intersect? Here's one instance where they did: John (in trenchcoat) and Herb (behind and to John's left) were in the same second grade class, presided over by the formidable Miss Pitchel.*



COURTESY HERB HEILBRUN



# That '70s Airshow

**Business, babes, and barnstormers.**  
**For a while, Reading, Pennsylvania, had it all.**

*by Roger A. Mola*



Robert Harding Breithaupt—“Breity” to everyone who was anyone in the aviation business in the 1960s and ’70s—holds court at table number 6 in the Antique Airplane Restaurant, which his family has owned since 1964. From his corner perch by the door, he greets each diner, usually a member of Reading’s graying community and almost always someone he knows. He pushes back his chair and cranes toward the belly of the gloss-black 1927 Monocoupe, N6731, that hangs from the beams. It’s the airplane in which he learned to fly. He had it trucked 15 miles across town from the airport via the West Shore Bypass and installed in the restaurant in 1967.

“It’s still licensed. Gas it up and fly it right out,” he winks to the ladies at the next table. Breithaupt, 84, reaches up to rock the airplane. The lunchtime patrons lower their forks, and John Cianci, a retired controller from the Reading Airport tower, reassures the ladies of the Monocoupe’s solid anchor. Breithaupt retakes his seat and resumes the conversation about the National Maintenance & Operations





Meeting, or, as it was known for decades, the Reading Air Show.

"Reading was considered the best show in the world in the '50s to the early '70s," says Breithaupt. "We came before the Oshkosh thing got big, and we ran the show out of our own pocketbook."

"This was a trade show," he says. "It wasn't selling balloons to the kids."

At its peak, Reading boasted a daily professional registration of 12,000. Its roster of exhibitors was a roll call of the big guns of aviation: Rockwell International, Grumman American Aviation, Boeing Vertol, AVCO Lycoming, Bell Helicopter Textron, Aerospatiale Helicopter, Pratt & Whitney, and Beechcraft, Piper, and Cessna. It was also a favorite venue for suppliers to the industry: AC Spark Plug, Teledyne Battery, Marathon Battery, Alcor, AVEMCO, Collins Avionics, BFGoodrich, Texaco, Mobil, Esso (later Exxon), and Shell. From humble beginnings in the 1940s, the show grew until in the late 1960s and '70s, it rivaled the biannual Paris show in attendance, if not in prestige. In 1980, it ended. Maybe it got too big for its britches.

*Airshow organizers happily mixed business with pleasure, registering 12,000 for the trade show (opposite) and thrilling big crowds with popular acts, like the U.S. Air Force Thunderbirds.*

reithaupt and Alfred M. "Sime" Bertolet bought Reading Aviation Service in 1941, when it was a sales and maintenance operation for light aircraft, dealing in little Ercoupes and Luscombes. They taught civilian pilots to fly and later got a U.S. Army contract for military pilot training. After World War II, during which Breithaupt flew B-24 Liberators in the China-Burma-India theater (he's never without his CBI belt buckle), RAS founder Brooks McElroy, also a military pilot, rejoined the company. In 1949 the trio launched the National

Maintenance & Operations Meeting.

"The initial shows were a thank-you party for our best RAS customers," says Breithaupt. "We invited them for the Pennsylvania Dutch food. We had no airshow. We had FAA dignitaries to speak, and seminars." The first performances, he says, were simply ad hoc presentations by some of the pilot-customers who happened to have flown their airplanes to the site. They had no schedule of acts.

"It was largely military surplus," says Cianci. "Everyone who had an airplane after the war suddenly became a barnstormer."

"An event like ours was a family reunion," he says. "Initially the show was free, then within five years we charged for exhibitors to set up. Then we ex-

PHOTOGRAPHS: ED SCHNEIDER, TONY LINK/FROM THE COLLECTION OF JOHN CIANCI



panded to two days." Eventually it became a week-long event, and by the mid-1960s, commercial registration was \$5 a day or \$10 for the week.

RAS also expanded into a leading modification center with government contracts for converting, overhauling, and painting C-47s and other military aircraft. It continued flight training and started a charter airline business, which led to the establishment of scheduled Reading Airlines, renamed Suburban Airlines in 1969. RAS sold Navions (Breithaupt sold 173 himself) and added Pipers and the popular twin-engine Aero Commander.

By 1970, more than 200 companies were returning every year in the first week of June to wedge their exhibits into eight- to 16-foot-wide booths set up in surplus Army barracks. Up to 650 airplanes parked on the ramp. Exhibitors would plop down \$3,500 for a hospitality chalet for the week—mobile homes with porches and canopies—"basically one big room with a bartender," says Cianci.

"All the major manufacturers served free beer and noshes, all hours," remembers Sheldon "Torch" Lewis, a columnist with *Business and Commercial Aviation*, who flew to Reading in the early '50s as chief pilot for Thatcher Glass and later as a sales rep for Gates Learjet. "There were open houses at the motels too." Dick Aarons, former editor and now editor at large of *Business and Commercial Aviation*, adds, "In those days, aviation was a hard drinking crowd. Chalets were more an excuse for a bar."

Reading had taken on a life of its own. It was a "transistorized Paris," according to Lewis, attracting the same big deal makers but cramming them into a small, come-as-you-are city, where the specialties were Macadamia nut pancakes, not coq au vin. The show is remembered today more for its social atmosphere and the aura of deal making than for the deals themselves. People who attended tell stories of cocktail parties, lawn parties, motel hospitality room parties, and chalet bars. With each memory, you get the equivalent of a roguish wink that tells you this was aviation's good time for its mostly male sales force, behaving in this central Pennsylvania town the

way they'd never behave at home.

Take, for example, the celebrated annual appearance of the Marathon Battery Girls, sporting Marathon Battery's slogan, "The Pilot's Bosom Buddy." They dressed in satin hotpants with matching jackets, the backs of which were embroidered respectively with "Faster," "Cooler," and "More Often." "Some of those girls were ahead of their time," observes Breithaupt. "They would roam the ramps in twos or threes and later in the afternoon, it would seem the T-shirts got wet. Accidentally. Though it happened every year."

The trade press loved Reading. *Air Progress* magazine lent its name to one of the most popular affairs: a cocktail party on the Tuesday night of show week at posh Stokesay Castle. On Wednesday nights, everybody went to a bash at Reading Motor Inn, hosted by Ziff-Davis, then publisher of *Flying* and *Business and Commercial Aviation* magazines. "We would have 2,000 people at a Reading cocktail party," says Dick Aarons.

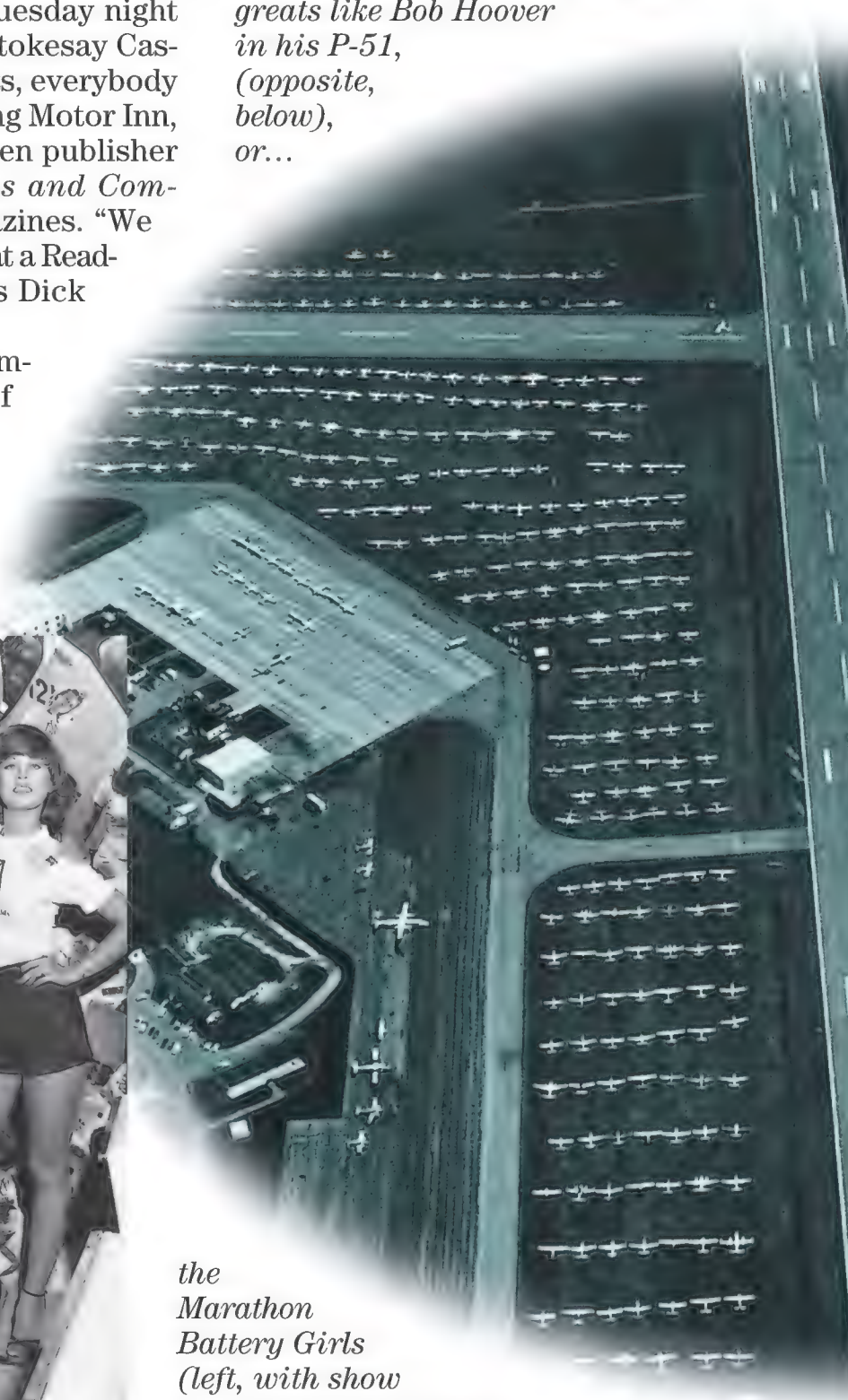
Jack Czarnecki remembers what the influx of partiers meant to the town of Reading. In 1916, his grandfather, Joe Czarnecki, had opened a bar in the town, lat-

er selling it to Jack's dad. "Joe's Restaurant" became one of the more upscale establishments in Reading, famous for dishes featuring locally grown mushrooms. According to Jack Czarnecki, his father transformed the business into a fine restaurant "when the Reading show started building" and later sold it to him. Czarnecki cherishes a letter he got one year from Moya Lear, wife of the energetic businessman who gave the world the Learjet, raving about the food and hospitality.

*What brought as many as 650 fly-ins to Reading every year? Was it the chance to see hot jets like the Harrier (opposite, top), airshow greats like Bob Hoover in his P-51, (opposite, below), or...*



*the Marathon Battery Girls (left, with show host Robert Breithaupt)?*





(Dick Aarons remembers Joe's: "A mushroom restaurant on the first floor of a Victorian house. Every dish had some component of mushroom and the walls were hung with mushroom portraits. Joe's martinis were served with a mushroom garnish. It was hard to find a mushroom tough enough to stand up to a martini.")

"I think exhibitors would return ev-

ery year for the food and parties, not the airshow," says Czarnecki. "During show week it was like every night was Saturday, a party. You would have large aviation fuel companies like Texaco and Mobil, airplane design companies. This was the day of the three-martini lunch and no end in budget," he says.

Cessna's representative at the 1978 airshow defended such expense to the

*Reading Air Show Daily News*, saying, "There's talk about the high costs of attending shows like Reading, but our dealers invite prospects here as their guests and show them some of the models that they might not have in stock. We are convinced that the resulting sales more than offset the cost

of the [hospitality] program."

"I don't remember that we sold anything at Reading," admits Torch Lewis. "We developed good prospects, especially if Bill Lear came. He was a great attraction."

former air controller John Cianci speaks in a confident voice known to tens of thousands of pilots as Reading Three. (Those who don't recognize the voice would be tipped off by his license plates: "RDG-3.") An area supervisor when he retired from the FAA in 1990, Cianci has amassed a collection of 4,500 photographs taken at Reading shows between 1946 and 1980, news clippings and memorabilia from those years, and a few unusual artifacts. The lights in his basement rec room are controlled by levers on a panel that looks like part of a sound system but

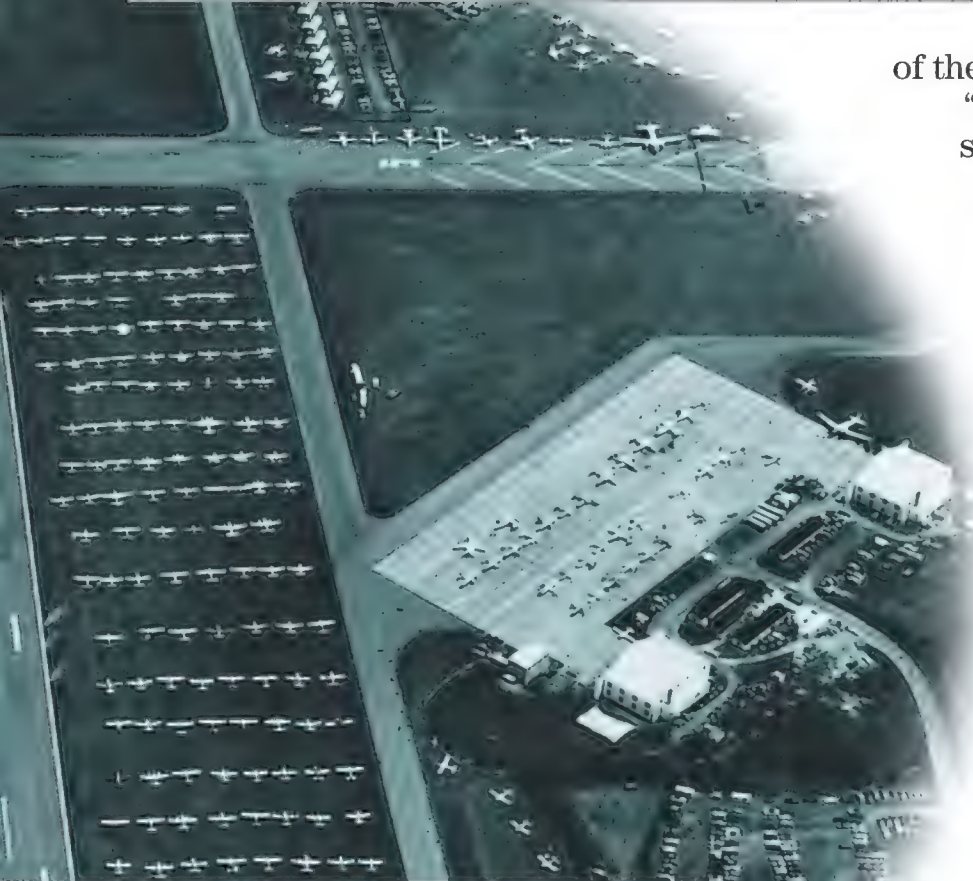
is in fact the airfield lighting control panel from the old Reading tower. Switch on Runway 18/36, and runway end indicator lights over the bar come on. What were once runway threshold lights illuminate his front walk.

Cianci was one of 12 full-time controllers at the Reading Airport; during the shows, 20 or more crowded the tower cab. "We would have holding patterns in three locations around Reading," he explains. "In 1966 there were 118 waiting. [The FAA] had regulations that the whole runway was yours once you got clearance for landing or take-off and that really backed them up. One pilot finally had to return to Wilmington, Delaware, to refuel."

That year FAA officials sat in on cab operations and, based on Reading patterns, amended air traffic procedures (ATP) 7110 to apply not just to airshows but to all commercial operations. The procedures thereafter eliminated the need to reserve the entire runway for a single arriving or departing aircraft. For the first time, single-engine Cessnas could arrive in trail at 3,000-foot intervals, or depart when the aircraft ahead was 2,500 feet down the runway.

The tower was the best seat in the house for flight demonstrations, which filled the afternoons and were interrupted only long enough to allow Allegheny Airlines to fly its scheduled runs to the airport. Each commercial product was allotted a six-minute slot for display, though exhibitors could buy two slots and fly for 12 minutes. Airshow star Bob Hoover demonstrated Rockwell's Aero Commander. "Reading was Hoover's first civilian airshow," says Breithaupt. "He was young and we took a chance, and paid him cash on top of Rockwell's fee. As a Commander dealer, we always had a plane on the rack for him."

On the weekend, Hoover also flew his P-51 Mustang in a routine that took full advantage of Reading's topography. The banks of the nearby Schuylkill River are precipitously steep. Hoover would depart from Runway 13, then sink and streak along the river 70 feet below eye level, leading the crowd to believe he had crashed. He would then fly north and pop up to surprise the crowd at the airport's other end.







*The Royal Air Force Red Arrows flew a routine in 1972 that spectators still talk about. Earlier shows focused on sales, from airplanes to survival kits (left). And every show was a party: The Stokesay Castle soiree (right) became an annual event.*



In 1970, Cianci recalls, Hoover's feigned crash almost came true. He had practiced his routine on Friday afternoon without incident, but on Friday evening the local utility had strung a cable across the Schuylkill, preparing to feed power to a new housing development. During Saturday's airshow, Hoover clipped the new wire with his left wing and it ripped away almost 10 inches from the wingtip. "Three inches lower and it would have sliced off

the wing," says Cianci. Hoover kept going, the crowd unaware that he had run into real trouble.

Bill Lear chose Reading as the occasion to introduce the prototype Learjet 23, 801LJ, in June 1964. "We took off in Wichita with an FAA inspector on board for final certification, even on the way to its introduction at Reading," recalls Gates Learjet pilot Torch Lewis. "The inspector was 'assisting' in the controls and inadvertently de-

ployed the spoilers. The Learjet crashed [at the] end of the field, but the pilot and inspector both jumped out and there were no injuries." Except, potentially, to the 23's reputation, so Lear took action. "Bill ordered number 802LJ to a rush finish that day and installed seats," says Lewis. "On the way to Reading he flew to Washington to pick up FAA officials, then on to the Reading show. He stepped off the airplane to a press conference for a huge crowd."



ach year Reading Aviation Service sponsored an awards competition to promote good maintenance and, indirectly, itself. Initially, the downtown Reading Crystal Restaurant hosted the gala banquet, but it later moved onto the field, along with white-glove catering for 300 and big bands. Cab Calloway was one of the entertainers. Arthur Godfrey came one year at Breithaupt's invitation and later became an honorary show chairman. The chairmanship evolved into a way to pay tribute to aviation heroes: Neil Armstrong flew in his Learjet to chair in 1974. In 1978, T. Claude Ryan of Ryan Aeronautical, builder of the *Spirit of St. Louis*, presided.

In the 1960s, Breithaupt began booking aerobatic performers to fly at the end of the day, after the product introductions had ended. Air show legends Daniel Heligoin and Montaine Mallet appeared at Reading, flying Cap-10s as the French Connection. "That's the first time an airshow had ever seen a horizontal outside loop," says Cianci. Reading was a favorite show of Art Scholl and his Pennzoil Super Chipmunk. Breithaupt also booked Mary Gaffaney, whom he called "the best female aerobatic performer, ever."

Because Breithaupt catered to commercial exhibitors, the performers didn't start flying until around 5 p.m. "My customers were the fly-ins and the exhibitors, not the drive-ins," Breithaupt says, referring to the thousands of residents of Reading and Birch County, Pennsylvania, who were beginning to compete with aerospace executives for parking and city services.

In 1966 Reading hosted its first military aerobatics team: the U.S. Navy Blue Angels, flying Grumman F11F-1 Tigers. Two years later, the U.S. Air Force Thunderbirds came to town in F-100D Super Sabres. Then in June 1972, the British Royal Air Force Red Arrows invaded Reading as part of their North American debut, flying Hawker Siddeley Gnats in a formation of nine. And the norms of airshow performance changed forever.

At the time, the term "energy toward the crowd" hadn't been coined, but Cianci intuitively knew the dangerous physics. Modern airshows set a safety buffer called scatter distance: the

product of the airspeed and the altitude the aircraft achieves at the most critical point of a maneuver. It is intended to provide breathing room if plans go astray (as they did in 1988, when Italian air force jets collided as one headed toward the crowd during a performance in Ramstein, Germany, killing 70 spectators and injuring hundreds). Today, flights over a primary spectator area must be straight and level or climbing, and in a direction perpendicular to the forward edge or "showline" of the cluster of fans, never during or while exiting an aerobatic maneuver.

"The Red Arrows didn't care," recalls Cianci, who says that the team flew "their most dangerous maneuvers directly towards the thickest part of the crowd. After performing, they did

**In 1966, there were 118 waiting. One pilot finally had to return to Delaware to refuel.**

a flyby within 100 feet of the tower, below our eye level—we were 65 feet in the tower cab—right over the chalets and VIP crowd."

Airshow performer Bobby Bishop, pilot of the world's smallest jet, the Bede BD-5J, remembers that 1972 appearance. "The Red Arrows were told by the FAA inspector, John Doster, to fly the routine the way they normally flew it," he says. "I was by my plane watching the airshow, and I didn't know which way to run. Bomb bursts right at the crowd, multiple solution crosses, and recovering 100 feet over the crowd's heads."

Cianci adds that even the Red Arrows' C-130 transport buzzed 150 feet over a line of 7,000 people. "You stupid Limey son-of-a-bitch!" I screamed at the C-130 pilot on my radio. Suddenly I see one of the show managers waving at me frantically from the ground and I realize that [the mike] was hot—live on the public address system to the entire airport. The Red Arrows pi-

lot just came back with that casual tone: 'Not to worry, Yank.' They did whatever they wanted. I had to send letters of apology to everyone, from the Mayor to the County commissioners."

When the military teams started flying, Reading management initiated a number of procedures that became routine at all air shows. Snow fences were added along show center to prevent jet wash from blowing over the light aircraft parked on the grass. Still, there were mishaps. In 1971 a hovering Harrier pilot burned a hole in the tarmac of Runway 13/31 that persisted through years of patches.

"We also had to lay down 30 to 40 white plastic strips for a total 4,000 feet for the military teams," notes Cianci, in one of the earliest experimental applications of the method used to mark the show centerline for pilots' visual orientation. "In the old days, they would just tell you to park a school bus or two as markers," Cianci says.

The military demonstrations brought bigger crowds. Greater Reading has a population of 120,000 and is surrounded by farmland. Show management snagged farm fields each year as temporary lots but provided no paved parking. Local farmers learned to price for what the market would bear.

"Everyone wanted to jump on the bandwagon of the show's success," Cianci laments. "A 15-cent cup of coffee suddenly went for 50 cents. The airport authority parked cars and collected trash, so they also wanted a piece of the action. All the restaurants in town escalated their prices during show week and rooms were twice or more the usual."

Still, he says, "Every motel room was filled, all the way to Pottstown, even at artificial prices."

Arrangements were made for overflow guests to stay in the dormitories of Albright College. Local roads were overwhelmed with traffic, especially at the end of a day, when product demonstrations ended and aerobatic performers took over. Businessmen, leaving the airport after a day of drumming up sales, clashed with incoming public show audiences on narrow two-lane roads.

"The infrastructure of Reading, Pennsylvania, was never really ready for





*In 1980, Reading held its last hybrid airtradeshows. It had hosted the Army's Silver Knights (above), the Air Force Thunderbirds (opposite), and sales crews for products large and small. One of the smallest had to be Jim Bede's BD-5 (right).*

this kind of show," says Czarnecki. "What happened is our restaurant would have reservations for 60 to 70 people but only have 30 come, because the local transportation system would break down. That continually worsened and no one in the city took action. When you've got an executive with a credit card waiting to take out VIP guests and he can't get a cab, he remembers and vows not to return."

Gradually, the exhibitors began to withdraw. Bendix passed on booth space in 1978 because like thousands, its representatives couldn't find a motel. Canadair showed up but decided that 1978 would be the last year. "It's the horde of non-aviation types and their kids, many of whom climb on airplanes and damage them, added to the fear that someone might injure himself poking around aircraft without knowledge," the Canadair spokesperson told a reporter at the company's last show.

In 1976, public attendance had mushroomed past 100,000 while paid, professional registration topped 12,800 each weekday. Only one year later, paid entry to exhibits had fallen to 10,108 and the number of exhibits to 163; nearly 100 less than a couple of years earlier. Nonetheless, the show remained a media favorite. Nearly 1,600 journalists turned up—one for every six registrants. Though the decrease in numbers that year was largely due to poor weather, the tumble was assured. Breithaupt and partners started discussing plans to hold "Paris on the Schuylkill," as some patrons called it, every other year, to alternate with the Paris Air Show. But in 1980, RAS ran its last show.

If you end up in the wrong part of the airshow business, it's like selling ski rides with no snow that winter," says Breithaupt. What happened at Reading was textbook trade-show herd mentality. Potential show exhibitors watch the big companies—Boeing, Grumman—to see if they will attend and therefore stamp the show as serious. Some show organizers give quiet incentives to these big companies, knowing that once they sign up, many others will rush in. Without heavyweight exhibitors, customers don't think the show serious either, and with fewer customers...you get the idea.

After five fallow years, Reading got a brand-new show—the 1985 Reading



# WELCOME TO THE 1980 READING AIR SHOW



Aerofest, staged by the Reading Airport Authority. It continued for several years as a single weekend event, Friday evening through Sunday. The show sponsored its own banquet without the involvement of commercial aviation vendors. Show coordinator Louise Grim added a merry-go-round, simulators, a space jump, and balloons and ice cream. Within two years the event had enticed the Thunderbirds to return, but the team had to stage from Harrisburg International Airport, which was 60 miles away but, unlike Reading, had a runway long enough to meet the Air Force's new minimum of 7,000 feet.

Aerofest's last show, in 1998, booked the Blue Angels, Ken High and his Super Shockwave jet truck, Robosaurus (which scoops up and crushes cars in his claw), U.S. national aerobatic champion Patty Wagstaff in her Extra 300S, Bobby Younkin in his Beech 18, and the A-10 Thunderbolt II Demonstration Team. Grim notes, "Hotel space and parking is still a problem here, due to airport development, along with new

FAA requirements for sterile areas during the performance of military teams."

Reading Aerofest directed auto traffic to county property beyond the airport boundary and bused in attendees. "It's very costly but it seems to help," says Grim. There were signs of the former profiteering that helped drive com-

**Everyone wanted to jump on the bandwagon of the show's success. A 15-cent cup of coffee suddenly went for 50 cents.**

mercial patrons away in the past. "Some of the areas near the county property we do need to—quote—rent for the weekend from farmers," says Grim.

Although Breithaupt still lives in Reading, he has not been to the local airshow since it changed formulas.

Joe's Restaurant closed its doors in 1996 after 80 years in business, partly

from the waning fortunes of the Reading show. Czarnecki moved to the Oregon coast, where he bought the small-town, Joel Palmer House restaurant. The house specialty: mushrooms.

John Cianci is at work on a book about the history of aviation in Reading. He says that for RAS, the show was really a 12-month undertaking, employing two people full-time with work on the next show beginning the Monday after a show closed. According to Cianci, RAS involvement grew more costly and time consuming each cycle. "They lost their maintenance people beginning months before, putting up fences and stages, and it took longer each year to pack away," he says.

Two years after the original show closed, Reading Aviation Service changed its name to that of its subsidiary Suburban Airlines. Maintenance operations had been winding down, but the airline continued its routes. In 1988, Suburban liquidated the last of the maintenance operation and sold its aircraft and routes to US Airways.

Although Reading Aerofest was intended to be an annual event, just as the Reading Air Show was for 31 years, the last three Aerofests had to be canceled when the organizers failed to recapture a jet team. —



# How Things Work:

by George C. Larson

Illustrations by John MacNeill

Back in the '50s, cars borrowed some of their wackiest design elements from jet airplanes, and now it's payback time. The swept surfaces that became tailfins on '57 Cadillac Eldorados are now appearing on the wingtips of airliners as fin-like devices called winglets. But these fins are not there for looks.

Winglets reduce wingtip vortices, the twin tornados formed by the difference between the pressure on the upper surface of an airplane's wing and that on the lower surface. High pressure on the lower surface creates a natural airflow that makes its way to the wingtip and curls upward around it. When flow around the wingtips streams out behind the airplane, a vortex is formed. These twisters represent an energy loss and are strong enough to flip airplanes that blunder into them.

Winglets produce an especially good performance boost for jets by reducing drag, and that reduction could translate into marginally higher cruise speed. But most operators take advantage of the drag reduction by throttling back to normal speed and pocketing the fuel savings.

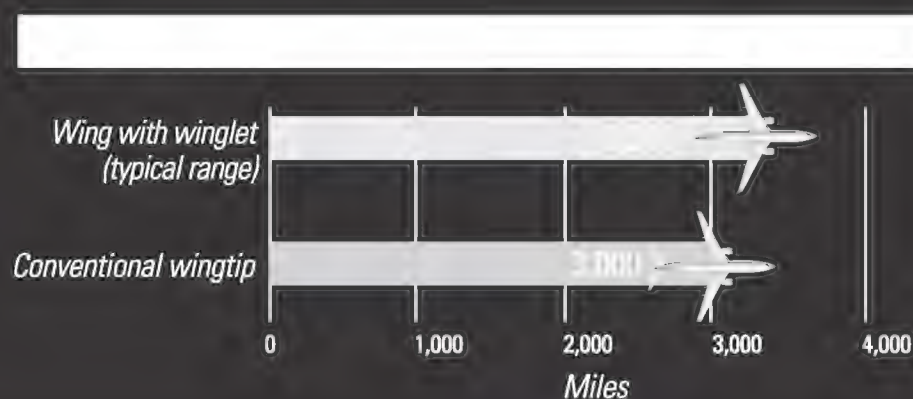
Several airliners use them. The Airbus A319 and A320 have very small upper and lower winglets. The longer-range twin-engine A330 and four-engine A340 have conventional winglets, as do Boeing 747-400s. Aviation Partners, a Seattle, Washington company, has a new design it calls a "blended" winglet. The Boeing Business Jet (opposite, top), a derivative of the Boeing 737, has a set of the firm's eight-foot winglets with a curving transition from wing to winglet that is characteristic of the company's design.

In 1976, shortly after an energy crisis sent fuel prices skyward, Richard Whitcomb, a NASA aerodynamicist, published a paper that compared a wing with a winglet and the same wing with a sim-

*Aviation Partners gave the Boeing Business Jet a new look with these "blended" winglets, which curve gracefully upward. Mere remnants of tip vortices trail from the tops of the winglets.*







ple extension to increase its span. As a basis for comparing both devices, the extension and the winglet were sized so that both put an equal structural load on the wing. Whitcomb showed that winglets reduced drag by about 20 percent and offered double the improvement in the wing's lift-to-drag ratio, compared with the simple wing extension.

The aspect ratio of a wing is the relationship between its span and its chord—the distance from leading edge to trailing edge. A U-2 has a high aspect ratio; an F-104 has a low one. A wing with high aspect ratio will provide longer range at a given cruise speed than a short, stubby wing because the longer wing is less affected, proportionally, by the energy lost to the wingtip vortex. But long wings are prone to flex and have to be strengthened, which adds weight. Winglets provide the effect of increased aspect ratio without extending the wingspan. One rule of thumb says that for an increase in wing-bending force equal to that of a one-foot increase in span, a wing's structure can support a three-foot winglet that provides the same gain as a two-foot span extension.

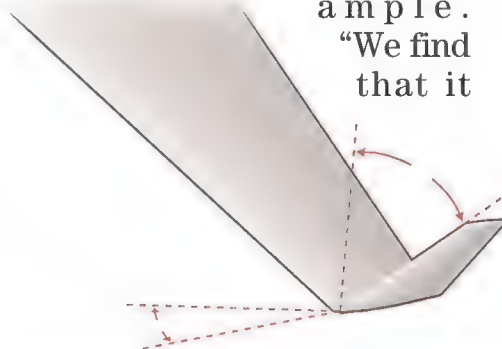
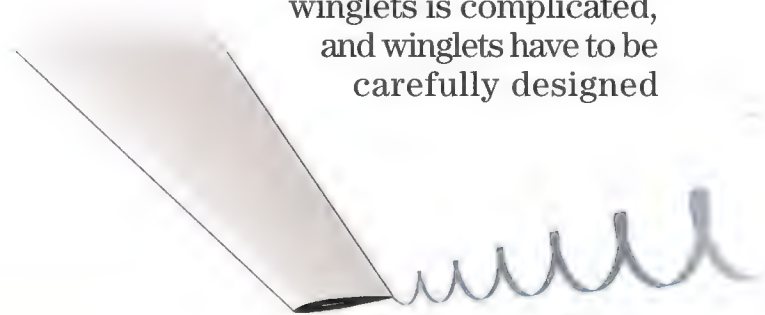
The airflow around winglets is complicated, and winglets have to be carefully designed

and tested for each aircraft. *Cant*, the angle to which the winglet is bent from the vertical, and *toe*, the angle at which the winglets' airfoils diverge from the relative wind direction, determine the magnitude and orientation of the lift force generated by the winglet itself. By adjusting these so that the lift force points slightly forward, a designer can produce the equivalent of thrust. A sailboat tacking sharply upwind creates a similar force with its sail while the keel squeezes the boat forward like a pinched watermelon seed.

If winglets are so great, why don't all airplanes have them? Because winglets are a tradeoff: In the highly visible case of the 777, an airplane with exceptionally long range, the wings grew so long that folding wingtips were offered to get into tight airport gates. Dave Akiyama, manager of aerodynamics engineering in Boeing product development, points out that designing winglets can be tricky—they have a tendency to flutter, for example. "We find that it

*Long, thin wings provide longer range than short, stubby wings. But shorter wings have inherently greater stiffness and save weight. Adding a winglet to a short wing can create the effect of increased span.*

really doesn't matter what kind of wingtip device you use—they're all like span," he says. "The devil is in the details. Span extensions are the easiest and least risky." In the past, winglets were more likely to be retrofitted to an existing wing than to be designed in from the start, but now that is beginning to change. Unlike those tailfins on cars, winglets really work.







# All Space

**For many, it was the mother of all vacations, a middle-aged millionaire buying himself the ultimate joyride. U.S. businessman Dennis Tito's tour of the International Space Station last April was also a certifiable pop culture event, and the media coverage it engendered, from launch to Letterman, should come as no surprise. Interest in space travel, after all, is not limited to the very rich, and media executives are always looking to satisfy (read: sell to) their audience.**

**If this desire for more direct access to space is not quite welcome news at NASA, which was furious at**

**by Todd Kliman**

PHOTO ILLUSTRATION: CHARLES LIVINGSTON





# All the Time

**Is NASA ready for prime time?**



Tito for forcing his visit at so early a time in station operations (and the nerve of him to hook up with the Russians!), neither is it really news. For the last several years the space agency has been changing—some say reluctantly—the way it gets its message out to the public. Or rather, how it allows others to get the message out.

It started with Hollywood. NASA has permitted a growing number of film directors to use machinery that was once the exclusive domain of real astronauts. Ron Howard filmed parts of *Apollo 13* aboard a KC-135 airplane NASA uses for weightlessness training, while Clint Eastwood slipped into the agency's gigantic water-filled neutral-buoyancy tank to shoot parts of last year's *Space Cowboys*.

Nor is it unthinkable anymore that film crews will go beyond simulations. *Titanic* director James Cameron has made no secret of his desire to send himself on the ultimate location shoot, and has approached NASA administrator Dan Goldin about visiting the International Space Station. In fact, the Canadian-born director has become, for Goldin, a kind of anti-Tito—willing to let the agency dictate when he might fly and under what terms. Speaking before a Congressional committee in May, as pictures of a gleeful Tito were being beamed back to Earth, the administrator said pointedly that Cameron understands “the right way and the wrong way to do things,” and was willing to wait until the space station partners work out a policy for allowing tourists on the orbiting outpost. No deal has been struck, but Cameron is already mulling over what he'd like to do if he gets up there: a documentary on the space station, maybe, or shooting footage to support his pet project—a series of productions about future human missions to Mars. Rae Sanchini, president of Lightstorm Entertainment, Cameron's production company, says the director “would see it as a working trip. He hopes to capture imagery that will excite people about the potential for space exploration, since he's such a believer that it's a critical part of man's destiny.”

Also hoping to excite the masses and rack up big ratings is Brainpool Television in Cologne, Germany, which envisions a reality-based TV show called “Space Commander,” whereby players would compete for a seven-day trip to orbit. Mark Burnett, the producer of the hit series “Survivor,” had originally intended for his follow-up effort to be called “Destination: Mir.” The Rus-

sian station's fiery fall to Earth earlier this year nixed that plan, and Burnett was forced to settle on the Australian Outback. But he hasn't altogether scrapped his plans for another reality-based space show, called “Destination: Space.” And amazingly, the idea no longer seems all that farfetched.

Of course, rocket ships and space shuttles always seemed to have been lifted straight from a movie screen anyway. Even the theatrical suspense of the “3-2-1” countdown, a staple of rocket launches since the beginning of the Space Age, originated not with an engineer but with a silent film, Fritz Lang's 1928 *Woman in the Moon*. What's new is that NASA has become more comfortable exploiting the connection between technology and entertainment.

The Toronto-based IMAX company, which has been producing space-based documentaries filmed by shuttle astronauts since 1984, pioneered this fusion with films like 1985's *The Dream Is Alive*, a 37-minute tribute to the space shuttle. But distribution has been limited to large-format theaters, such as the one at the National Air and Space Museum in Washington. And even though IMAX has settled into a steady relationship with NASA—the company is already shooting film aboard the International Space Station—the involvement of partners like the Museum has lent the company's space films the sober aura of public information rather than show biz.

However, the climate really started changing at NASA in 1992, when Goldin took over as Administrator. At the time, says Keith Cowing, a former agency scientist who now edits a savvy insider's Web site called [nasawatch.com](http://nasawatch.com), “NASA needed to be shaken out of its complacency. Many sacred cows needed to be slaughtered.” Dan Tam, who heads NASA's commercialization office, remembers Goldin issuing an early manifesto claiming that “We have not done a very good job in communicating with the rest of the world.” Alan Ladwig, who left his job as the head of NASA's policy office in 1999 to help launch a Web site—*space.com*—and has since gone on to become a consultant, says, “One of the things Goldin recognized is that you need public support. The question is: How do you get that support?”

An ardent Trekkie, the new administrator

*Dennis Tito (top) has already been to the new International Space Station. Hollywood directors may follow.*





turned to the entertainment industry. Goldin created a previously unheard-of role at NASA—that of Hollywood liaison—and in 1997 hired Bobbie Faye Ferguson, a former actress with connections to the Clinton White House, as the director of multimedia services. Ferguson brought a Rolodex filled with show business contacts. Only a few years earlier, NASA had been a reluctant player, but under her direction, it began seeking out Hollywood as a potential partner.

The ending of the cold war had brought a decline of spy films, but as one genre died, another was born. The movie industry could hardly believe its good fortune. Says one producer, “Hey, if [NASA] wants to work with us, great. You’d be crazy to turn that down.” By the late 1990s, the studios were starting to churn out stories about space adventures and heroes, from *Armageddon* to *Deep Impact* to *Mission to Mars*.

Ferguson has since left the agency, but Paula Cleggett, the deputy chief of NASA’s public affairs office, says the agency is still pursuing relationships with filmmakers. “Do we have an office on Hollywood and Vine? No.” But, she says, “We’ll arrange a tour of the Kennedy Space Center, let’s say. Introduce them to specialists. Get them talking, that sort of thing. We want to encourage this. We want to reach as many people as we possibly can, and reaching them through Hollywood is one of the ways to do it.”

This fit in nicely with Goldin’s larger vision of a new and improved space agency. The Administrator’s “care and feeding of the Hollywood studios,” as Cowing puts it, would mean better PR. And that might translate to increased public support and Congressional funding, and perhaps even NASA’s survival as it slouched toward the 21st century without a clear mission, such as landing on the moon.

Meanwhile, the Internet took off, the number of cable TV channels multiplied, and the number of media outlets mushroomed from a handful into thousands. Could the space program, an icon of the 1960s, sell in the fickle new media marketplace? The answer—a resounding “maybe”—came with the Mars Pathfinder landing in 1997. For the first time, images beamed from another planet could be viewed ’round the clock on your desktop computer. The public was fascinated by the novelty of it all: People around the world downloaded pictures of the Sojourner rover rolling across the surreal red landscapes of Mars. NASA’s Pathfinder Web site got 46 million hits in a single day, which was, back then, a record. Surely there was a market here somewhere.

But to talk about a private space information-entertainment business was to talk about a different kind of NASA. Some at the agency did not want to have that conversation.

“You had people here who went back to the Apollo days,” says Dwayne Brown, NASA’s acting director of media services. “Historically, this is a very conservative place. There’s a lot of military presence.”

Still, with Radio Shack now filming commercials on board the space station and Pizza Hut sending up pizzas (Tito’s Russian crewmates were the delivery boys, and station commander Yuri Usachev starred in the TV spot), the old ways appear to be vanishing fast. Sensing a new market, Spacehab, a Houston-based firm that builds laboratory modules for conducting research in orbit, last year spun off a venture with the Russians called Space Media, which would use a new commercial module, Enterprise, that the company hopes to dock to the space station in order to “develop space-related media and edutainment [*sic*] opportunities.” The business plan may have been slightly ahead of its time, however. A year later Space Media was laying off staff, and is now biding its time before rushing to put the first studio in orbit.

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While we wait, there’s NASA Television. The agency’s in-house TV channel, which debuted in the 1980s, broadcasts video—mostly, but not entirely, without commentary—of shuttle missions, press conferences, and other events of public interest. The signal can be picked up by any local cable service, and is Webcast on prominent sites like Yahoo. It began, says Brown, “as an engineering tool, monitoring the work that was being done on a particular mission.” At first, when nothing was happening in space, the screen went blank. Today, though, NASA Television has original programming with peppy hosts who, if not quite ready for prime time, add pro-

duction values to the raw feed. NASA Television is no longer just for agency employees and geeks. “Now it’s defined as a news source,” says Brown.

Building on that experience, the agency has begun looking into what NASA Webmaster Charles Redmond, lapsing into new-media-speak, calls “a streaming media distribution scheme.” Translation: production of real-time content for television and the Internet. Redmond envisions a full slate of daily programming, including, he says, “a sort of *TV Guide*” that would give viewers a daily schedule of programming. And what might the schedule include, besides the occasional footage of a space launch or look inside the space station? “It might be scientists practicing robot missions; it might be scientists in the classroom, teaching,” he says.

“Survivor” it ain’t. But that’s just fine by NASA; entertainment is not the goal. Nor is openness, necessarily. NASA Television, whether distributed by cable or over the Web, will still show only what NASA chooses for us to see. That doesn’t sit well with some, who worry about what



Redmond calls the “tension between freedom and control.” James Oberg, a space writer who spent 22 years working as a spaceflight engineer in Houston and who is currently writing a book about the U.S.-Russian space alliance, has been a persistent critic of NASA’s claims to openness. In a recent column in *USA Today*, Oberg complained about the agency’s editing, or “redacting,” of journals kept by the International Space Station’s first commander, Bill Shepherd, during his stay in orbit last year. Numerous passages in Shepherd’s commentary were deleted before his “ship’s logs” were posted on the Web. “Occasional lapses in candor by NASA media officials in the recent past raise concerns that a monopolized information flow will be a slanted information flow,” Oberg wrote. “‘Happy talk’ is easy, but rigorous candor about problems takes a level of effort—and a mindset—that has sometimes been lacking.”

The question of who decides what the public gets to see will certainly come up if non-NASA employees start shooting film in orbit. NASA watchers already complain that the agency is selective about which movie projects are granted access to its training facilities on the ground. The producers of last year’s *Red Planet*, for example, were not allowed to film on site at NASA centers, while *Armageddon* and *Space Cowboys* were granted the full benefit of NASA’s technical assistance. The agency reportedly was miffed at the makers of *Red Planet*, which had Val Kilmer and crewmates acting at times like fraternity brothers on a road trip. “It did not portray the values that we see in our astronauts,” says Cleggett of NASA public affairs. “It was un-astronaut-like—put it that way.”

Toni Myers, who heads IMAX Space Ltd., dismisses the notion that NASA’s hands-on involvement compromises the integrity of her company’s space-based documentaries. Calling from a “customer support room” adjacent to mission control, where the producer was screening video beamed live from the International Space Station, she says, “These films are a tool to get people reinvigorated, to show the public what NASA is up to. To do what [NASA is] trying to do, you’re going to need huge public support.”

Is the agency practicing censorship? “I wouldn’t say that at all,” she bristles. “They never came to us about something we said we wanted to do and said ‘Don’t do this.’”

Myers, who worked on the IMAX films *The Dream Is Alive*, *Blue Planet*, *Destiny in Space*, and *Mission to Mir*, says that after 15 years of collaboration, a comfortable working routine has evolved between IMAX and the space agency. Myers typically develops a scene list for each mission, which NASA reviews. Working together, the two groups arrive at a shooting schedule. Whether this micromanaging infringes on the creative freedom of her production crews is beside the point, says Myers. “The reality is, this is dif-

ferent from any other kind of documentary. There are issues to account for, a certain protocol that has to be followed very, very carefully [involving] crew safety and so forth. These projects are so difficult to pull off in the first place that it doesn’t really become an issue.”

She contrasts her work with Michael Moore’s ambush-style documentaries, such as the 1989 *Roger and Me*, a black comedy about layoffs in the auto industry: “It’s about as opposite from that as you can get.”

There is, of course, a marvelous payoff. In exchange for playing by NASA’s strict rules, IMAX gets the goods: intimate glimpses of aerospace arcana, the view that only astronauts normally get. “It’s important for us—our mission, really—to not gloss over the details,” says Myers. “I think that with more out there [on] the cable channels and the Internet...and with a broader fan base, the details become that much more important.”

Tom Rooker, a film producer who worked on *Space Cowboys*, agrees that moviegoers have become more sophisticated and thus demand accuracy and realism. “Everybody and their dog is looking at things in greater and greater detail,” he says. “The public is getting incredibly jaded. When I was growing up, we were astonished by something like a puppeteer. Nowadays, everybody knows everything. Your typical five-year-old has seen *Toy Story* and *Toy Story 2* and all those amazing things that can be done.”

In fact, says Rooker, what motivated Eastwood to make his film was the wealth of detail and technical assistance that NASA, and only NASA, could provide. The negotiations between Mad Chance, the movie’s production company, and the space agency took a year. “And that was mostly just the arrangements, figuring out the logistics,” says

Rooker. The filmmakers granted NASA full script approval. Drafts were vetted by flight directors at both Houston and Cape Canaveral, which weighed in with their editorial comments. “They looked over our shoulders,” Rooker admits, “but they would always, in the end, accept what we call a ‘feasible fiction.’” And, in the end, Mad Chance got exactly what it wanted. It got the details. For example, it got the answers to questions such as “When you latch in your feet, does that keep you stable?” and “What is the proper sequence of buttons to push for a shuttle landing?” Not everyone knows these things, says Rooker, but there are “enough people out there who do.”

More productions are in the works, and not just for the big screen. Space-based storylines, says Paula Cleggett, should soon find their way onto prime time TV. And always looming are the new media pioneers who think space can sell big on the Web. The space.com Web site has become an Exhibit A for this argument, and has been carefully scrutinized for the many sobering lessons to be learned.

**These films  
are a tool to get people  
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Myers, head of IMAX  
Space. “To do what NASA  
is trying to do, you’re  
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public support.”**



In the heady days of the Internet boom, space.com looked for all the world like a can't-miss proposition. It was well-financed, it had Sally Ride and other big names on board, and it even opened offices in NASA's own headquarters building in Washington. Lou Dobbs, a former CNN anchor and space enthusiast, was in charge. NASA officials started talking excitedly of having a new way to communicate with a new generation.

Instead, only two years later, the company had closed its Washington office. Traffic on the site has continued to decline. And though Dobbs had once boasted of the private sector's support for space.com, the outfit has been, say observers, hemorrhaging money and on the verge of failure. Some point the finger at the bottoming-out of the dot-coms and the stagnation of the economy in general. Others chalk the company's waning fortunes up to a simple case of miscalculation. "Like a lot of Web startups," says Ladwig, "the revenue model wasn't what it was cracked up to be." Besides, he adds, "space is a niche market."

Three months before stepping down to return to television last spring, Dobbs admitted, "We're faced with what everyone else is—the Web is a lot trickier than expected." The burning question, says Ladwig, is still "How does a private company come in and make money off something that's in the public domain?"

A new venture called Dreamtime finds itself in much the same predicament. The San Francisco-based company owes its existence to NASA's desire to have someone else take over much of its multimedia service, including digitizing its vast photo collection. Shrewdly merging the worlds of Silicon Valley and NASA, Dreamtime won a highly prized contract last year to partner with NASA on a range of products, including television programs.

The newly formed company beat out 12 others, including

*Would the same audience that liked Tom Hanks in Apollo 13 (top) and Space Cowboys (second from bottom) tune in to watch real NASA missions?*



space.com, largely on the strength of its track record in the new economy (the founders had created the Excite@Home Web site). Dreamtime promised to invest up to \$100 million on such innovations as high-definition TV, and claimed it would provide the public with its most detailed pictures yet of the space station.

More than a year later, the project remained in the development stages, and NASA's inspector general was asking rude questions about whether the whole deal was too favorable to Dreamtime. Some speculate it will never happen.

Dan Tam, NASA's commercialization czar, understands the pessimism. "They should be skeptical," he says. "This is a startup, and there's no guarantee it will be successful." Bill Foster, Dreamtime's CEO, remains hopeful. In fact, to feel his salesman's energy and enthusiasm is to wonder if the doubters have ever spent any time in his company. "It's our belief that space can be turned into education and entertainment and be profitable too," he says. He points to a television program Dreamtime

is developing, an "incredible kids' show" with characters who can "interact with you in real-time. You may call this educational. Somebody may call it a game show or a video game or whatever.... There are no boundaries. Why should there be?" The program will air on NASA Television, he says. Eight or nine other Dreamtime projects are in the works, ranging from documentaries to TV game shows.

For Foster, and for NASA too, the programs are more than just entertainment; they're promotional tools. "The question," says Foster, "is how are we gonna get a generation of kids who never saw Neil Armstrong and who play video games all day to see the importance of space and science?"

Sending them into orbit is one way, but most of us don't have Dennis Tito's millions. So until the price of a ticket comes down a bit, we may have to count on Foster, James Cameron, and the rest of the entertainment industry to take the trip for us, and give us a vicarious sense of what it's like. ➤



# COMM

## Air Rage Relief

**The next big air disaster could be caused by an out-of-control passenger. But the airlines refuse to face the problem.**

*January 9, 2001: Flying from Chicago to Hong Kong, a man began spitting at passengers and screaming obscenities. He ripped a telephone from the hands of a flight attendant and threw a liquor bottle at a child...*

*October 20, 1995: On a flight from Buenos Aires to New York, an intoxicated investment banker who had been refused more wine responded by defecating on a food cart...*

*April 23, 2001: Twin sisters, flying from San Francisco to China, got into an argument, during which one threatened to open an airplane door. When the crew tried to stop the disturbance, the sisters punched one flight attendant in the nose, put another in a headlock, and struck a pilot in the head...*

It's bad enough that nasty incidents like these happen at all. Today, they're actually common. The Air Transport Association estimates that the number of air rage incidents on U.S.-based carriers is about 4,000 each year.

But this alarming problem isn't getting the attention it should. Airlines are not required to inform the Federal Aviation Administration of every instance of crew interference—the industry term for air rage—so they don't. Consequently, the FAA's statistics on air rage incidents include only those that lead to enforcement actions. The agency recorded 320 instances in 1997, 282 in 1998, and 310 in 1999. Because the true magnitude of air rage is concealed, policymakers cannot appreciate the seriousness of the problem. And since only the most dramatic incidents make it into the news, the public does not know just how widespread the problem really is.

Or how dangerous. According to a study that NASA's Aviation Safety Reporting System conducted of 152 crew interference cases last year, in 40 percent of the instances, pilots either had to leave the cockpit to quell a disturbance or were distracted by a flight attendant seeking assistance. In a quarter of the cases, the incidents appeared to cause the pilots to commit such errors as flying too fast, going to the wrong altitude, or taxiing across runways reserved for other aircraft. And on at least five occasions last year, out-of-control passengers broke through locked cockpit doors.



The increase in air rage incidents probably stems in good part from the frustrations passengers are increasingly experiencing these days. Flights are overbooked, lines are long, and delays have become routine. Passengers are sardined into tiny seats with little legroom, overhead baggage compartments stuffed to the gills become battlegrounds, and the snacks and services passengers are offered are stripped to the bone. At the same time, on many flights the alcohol flows liberally, low-

ering inhibitions and impairing judgment. The combination of all of these factors has the potential to combust into a situation that threatens the lives of every passenger.

So what is the industry doing to prevent outbreaks of bad behavior? Mostly looking the other way.

For one thing, the airlines provide their flight attendants with little or no training for the problem, leaving them to figure out solutions at 30,000 feet. Last year, our organization, the Association of Flight Attendants, part of the AFL-CIO, surveyed our airline safety representatives and discovered that only three of the 17 believed that their flight attendants were adequately trained to deal with crew interference. And at the few airlines that do offer training, the lessons consist of a few pages in a manual or a ten-minute classroom presentation.

The result: Flight attendants are inadequately trained in even the fundamentals of conflict resolution, such as the most effective language to use to persuade an uncooperative passenger to obey safety instructions, or the best steps to take when a passenger appears to be intoxicated.

A few airlines—United, US Airways, Alaska Air, and Aloha—have come up with the idea of providing flight attendants with plastic handcuffs—but no proper training in how to use them. A flight attendant brandishing handcuffs would likely incite more violence in an already precarious situation. And a flight attendant with inadequate training and practice in how to use them could certainly precipitate a disaster.

Since 1996, AFA has been fighting to require that all flight attendants be trained in preventing and handling incidents of air rage. In response, the FAA took a small step in the right direction, issuing an advisory circular that suggests airlines establish policies and training for crew interference. But



# editorial

this was only a suggestion, and the airlines are free to ignore it. Our survey last year revealed that five out of 17 carriers still had no written policies on air rage.

Requiring appropriate flight attendant training is one part of a multi-faceted approach my organization advocates for dealing with the problem of air rage. We also believe that the FAA must direct the airlines to adopt zero-tolerance policies on crew interference so these incidents do not go unpunished. In addition, the agency must require airlines to report all incidents, and must enter every incident in a national database. With full reporting of the types, severity, and number of problems, airlines can provide realistic, hands-on training targeted at the most common and dangerous types of incidents.

Since alcohol is a factor in many air rage incidents, airlines must take overconsumption seriously and adopt responsible policies. Gate agents must be trained to recognize signs of intoxication and prevent drunk passengers from boarding. Airlines should end the practice of serving alcohol before take-off, and should never use free alcohol as a way to compensate passengers for delays.

Other strategies, such as deducting frequent flier miles from passengers who become unruly, may not quell the inappropriate behavior up front, but could prevent repeat offenders from terrorizing more flights.

While these ideas may seem like common sense, the airlines take the position "The *paying* passenger is always right."

It all comes down to money. One big reason airlines are in no hurry to give their flight attendants decent training in air rage management is the time and money such training would entail.

And of course, the overbooking, cramped conditions, and stripped-down in-flight amenities and services are obvious results of the airlines' determination to squeeze the maximum revenue out of every flight. Finally, airlines probably fear that taking a strong public stand against crew interference could cost them passengers, since some may interpret such a message as a sign that air travel is potentially dangerous.

But a strong stand must be taken. Both the airlines and the FAA need to get the word out that air rage is a felony, one with serious consequences. Just as security checkpoints display posters that warn against joking about terrorist acts, airlines need to provide passengers with written warnings about crew interference and the penalties against it; that can be done via safety cards in seat pockets, on ticket jackets, in in-flight magazines, and on posters and other displays in airports, especially situated near the bars, where some passengers spend time during

delays and layovers. And the preflight safety briefing should include a warning to passengers that crew member interference is a crime.

On the ground, law enforcement officers must have a clear knowledge of how to handle unruly passengers once a flight is over. Confusion over jurisdictional issues has resulted in some perpetrators of air rage walking away free upon landing. A federal law was passed in April of last year authorizing a program to allow local law enforcement officials to be federally deputized to assist in these situations. But implementation has been spotty. Jurisdictional problems are also common on international flights. AFA is committed to addressing this issue on an international level, working with governing bodies like the International Civil Aviation Organization.

In April of last year, the Congress increased the civil penalty for interference with a flight crew. Air rage is punishable by up to 20 years in prison, a \$10,000 fine, and a civil penalty of up to \$25,000. But imposing penalties after the fact is not enough. We must deter these acts, making everyone aware that the policy of both the airlines and the government is zero tolerance.

Take the example of a U.S. magistrate in New Mexico, who said as he arraigned a passenger accused of air rage, "You have absolutely no right to endanger anyone on an airplane." The judge ordered the passenger to take a bus back to his home state of Florida to await his trial, adding, "...if you cause a ruckus on the bus, they'll put you out in the desert."

We need more judges like him. And we need more regulations to prevent air rage in the first place.

Patricia Friend is the international president of the Association of Flight Attendants, the world's largest flight attendant union.



DAVID POVILAITIS



# Save the B1. the Blimp Base



*by John Sotham*

**From this Naval air station  
airships hunted U-boats  
in the Florida Keys.**





ust outside the fences of Miami's Metrozoo—a 740-acre park where sleek monorails glide above a faux African plain—sits a handsome two-story wooden building surrounded by tall grass. A few boards hang askew from its clapboard exterior, and the roof above its portico is held up temporarily with steel girders. To get here, we've threaded our cars through a forest of spindly pine trees to this reclaimed clearing, a journey that evokes an exciting sense of discovering something forgotten. Just outside the building's entrance, Navy Petty Officer John Smith yanks the cord on a portable generator, which coughs to life. A few lights flick on, and we head down a creaky hallway and enter a large storage room, where a slide projector sits on a table and overturned paint buckets serve as seats. It's hot in here.

We're inside what was once the headquarters of Naval Air Station Richmond,

*Pilot James Sinquefield (opposite, inset) once flew blimps housed within NAS Richmond's massive wooden hangars.*

a blimp base hastily constructed in the early months of World War II. As the slide projector clatters, Naval Reserve Chief Yeoman Anthony Atwood narrates and two former crewmen, who launched on blimps near here, stand by to lend their voices to the story. The crewmen, Ford Ross and James Sinquefield, have joined a small band of enthusiasts organized by Atwood who want to restore the headquarters building and convert it into a museum.

As Atwood talks, his hands make shadows on the sepia-tinted photos flashing on the wall. "Richmond was eventually home to 25 K-series blimps, three hangars, and 3,000 men," he says. "The hangars were 16 stories tall, built of Douglas fir brought in by train. The blimps protected ship convoys in the Florida Straits, and [Richmond] was the headquarters for the fight against Nazi U-boats operating in the Caribbean."

Ford interrupts: "That's not a K-type blimp, Anthony, that's an M-type."

Atwood rolls his eyes. "Okay, okay, as I was saying..." he says.

The story proceeds, and the enthusiasm brims. Atwood, Ross, and Sinquefield tell me that except for this

building, the only other above-ground remnant of the base is one of the massive hangars' corner pillars, which stands about 300 yards away. But other clues to the site's past are around, if you look carefully. Directly outside the building under the relentless subtropical undergrowth, Atwood's vol-

*Above: The Navy's behemoths graced south Florida skies until 1945.*

*Today, Naval Reservist Anthony Atwood (below, in uniform) leads a band of volunteers trying to save the air station's headquarters building.*



CARL JUSTICE (2)



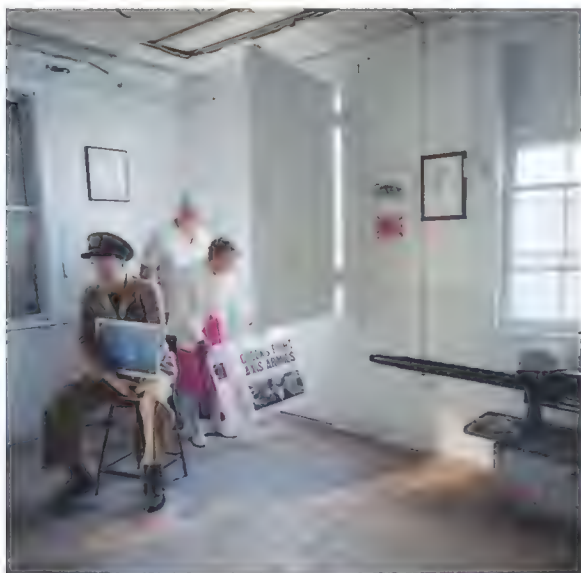
unteers found a four-foot-wide Marine Corps emblem the Marines had placed next to NAS Richmond's flagpole. And the old ramp is in plain view—it's now part of the parking lot at the zoo. Families who've come for a nature experience exit their minivans where ground crew released the mooring lines that sent the lumbering blimps on their lonely patrols for German U-boats.

Shortly after the attack on Pearl Harbor, enemy submarines began bringing the war close to the U.S. mainland. In late 1941, a Japanese submarine shelled a highway outside Santa Barbara, California, and on the Atlantic coast, U-boats would sink 574 U.S. and Allied merchant ships in 1942. When the war began, the U.S. Navy had only 10 blimps capable of coastal anti-submarine patrols. Soon more than 200 would join the fleet.

Most of them were K-type airships, powered by two Pratt & Whitney R-1340 Wasp engines, which gave them a top speed of 77 mph. Their envelopes were three-ply cotton bags impregnated with rubber or synthetic neoprene. The interior was coated with paraffin to make it leakproof. Most of the K-ships were 252 feet long and held as much as 456,000 cubic feet of helium. But when deflated, the five-ton envelope could fit into a shipping box 12 feet long, six feet high, and six feet wide.

Fleet Airship Wing Two was formed at newly built NAS Richmond to cover the Caribbean. On July 18, 1943, K-74

*Revisiting the HQ building: Ken Fox was a machinist's mate when he met his wife Elizabeth, a civilian employee at the base.*



CARL JUSTE



NASM



COURTESY NORMAN POLMAR

*K-type blimps (top) logged thousands of hours scouting for submarines like U-185, which was sunk by aircraft from the USS Card.*

and K-32 lifted off their concrete pads and rose over south Florida for a routine patrol. K-74 was headed for the upper keys, while K-32 was to fly farther out to sea, turn south toward Key West, and finally head north again. Later that evening, both airships would be in position to keep watch over a tanker and freighter scheduled to pass from the Gulf of Mexico through the Florida Straits to the open Atlantic.

Blimp patrols were mind-numbingly boring, lasting as long as 12 hours. Armed with a single .50-caliber machine gun and four depth bombs hanging from racks beneath their control cars, the craft were hardly intended for heavy combat. Their crews were ordered to monitor the positions of friendly ship traffic and report any sightings of U-boats, which could then be attacked by warships, if any were in the area, or by fighters from Naval Air Station Key West.

RIGHT INSET: DEPARTMENT OF THE NAVY



**Bombardier  
Isadore  
Stessel**



K-74's skipper, Lieutenant Nelson Grills, commanded a crew of nine: co-pilot Jay Jandrowitz, navigator Darnley Eversley, mechanic J.L. Schmidt, bombardier Isadore Stessel, radiomen Robert Bourne, J.M. Giddings, and John Rice, gunner G. Eckert, and seaman J.W. Kowalski. As the craft took up its station over the straits, U-boat U-134 was running on the surface and recharging its batteries, its crew on deck enjoying the fresh night air. The blimp's crewmen first saw two blips on their radar, clearly the merchant ships they were monitoring. Then, near midnight, they saw a third blip. They moved forward to investigate. And there it was:

a German submarine, on the surface and headed in the direction of the two merchant ships. There was no time to marshal aircraft to intercept the sub. Grills descended to 250 feet and opened the throttles to bring the blimp to its maximum speed.

"We were in a tough spot...", Grills told Anthony Atwood in 1997. "We decided that the best we could do was see if we'd draw fire. We felt that saving those ships was worth the blimp."

The German crew saw K-74 and opened up from the conning tower with a 20-mm cannon. Grills' crew returned fire. As the blimp passed over the submarine, the sub's deck gun shot up its

envelope and damaged its engines, which caught fire. According to Atwood, the crew released their depth bombs, but as the airship's aft section passed by the submarine, K-74 took more fire and began to lose altitude. Within minutes, it settled into the waves and U-134 slipped away into the night.

The crewmen scrambled out of the control car's hatches and inflated their life preservers, but their raft floated away before they could board it. Within minutes, one of the merchant vessels K-74 had been monitoring cruised past, oblivious to the recent battle. Its sailors didn't see the blimp's crewmen in the water, clinging to each other to

Fleet Airship Wing Two was headquartered at newly built NAS Richmond in 1942. The base's 15 K-type blimps patrolled the Straits of Florida to watch for German submarines preying on merchant ships. Richmond crews flew 7,750 missions during the war, including one in which Isadore Stessel died after his blimp was shot down by a U-boat. He became the only blimp crewman to be killed in combat. Just weeks after the war ended, Richmond was threatened by another enemy that lurked at sea: a hurricane.



Control tower



Blimp



Crew



Firehouse

DEPARTMENT OF THE NAVY (4)





DEPARTMENT OF THE NAVY

*The control car of a K-ship housed a crew of 10, radios, and a .50-caliber machine gun. Two Pratt & Whitney R-1340 engines thrummed outside.*

stay together. Radioman Bourne had managed to send a message to Richmond before the blimp went down, and by morning, a rescue aircraft spotted the men and directed a rescue ship to pick them up. But Isadore Stessel had become separated from the rest, and as he waved to the aircraft, he was attacked and killed by a shark. Grills had become separated too. It wasn't until later that evening, after spending close to 20 hours in the water and fending off another shark, that he was finally spotted by K-32 and rescued.

Grills and his crew were initially under a cloud of disapproval for attacking the sub against orders and for the loss of the blimp. But after the squadron commander interviewed the crew, Grills, and later the rest of the crew, received the Purple Heart. It wasn't until 1961—after analysis of German records revealed that K-74 had damaged U-134—that Grills received the Distinguished Flying Cross.

Still, vindication for one member of the crew was slower in coming. It took 40 years for the Navy to give a commendation medal to Isadore Stessel's family. "It was a bunch of 19- to 20-year-old kids in a blimp risking their lives," says Saul Stessel, Isadore's cousin. "They did damage that sub—the radio contacts give evidence that the blimp hurt them and they could not submerge. It was [later] attacked by a Navy Avenger [torpedo bomber], and it got as far as Spain until it was attacked by a [Royal Navy] Liberator and sunk."

The shutdown of K-74 is the only recorded combat loss of a blimp during the more than 500,000 hours of patrols flown worldwide during the war.

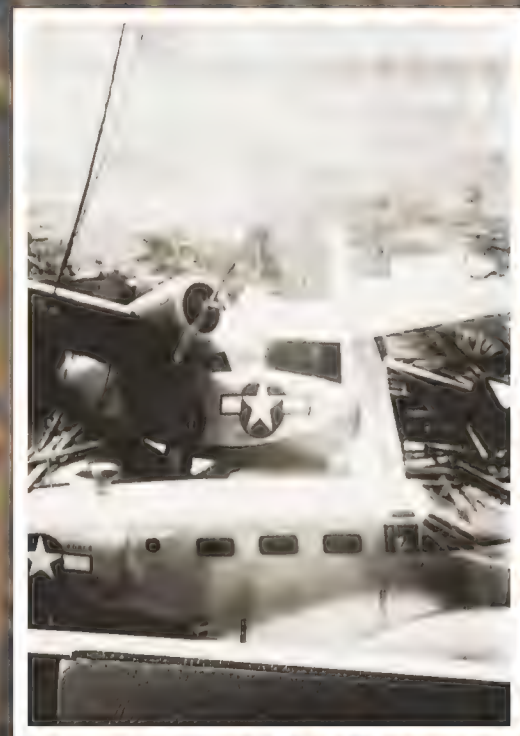
The sawgrass is whipping through the open windows of a Hummer, the civilian version of the burly military Humvee. Alan Crockwell, an amateur historian who volunteers his time to a growing effort to preserve Richmond's headquarters building, guides the vehicle to a flat table of asphalt surrounded by pine trees. We've parked where one of Richmond's three blimp hangars once stood—massive 1,086-foot-long structures made of wood beams and hung with sliding iron doors, whose graceful roofs arced to 183 feet.

As the war drew to a close, the base's K-series blimps were joined by new M-series ships that the Navy tested here. But in September 1945, scarcely two months after the war was over, the base was called upon once again to face down an enemy lurking at sea—a hurricane tracing a lazy path through the Caribbean. At the time, hurricane prediction was a shaky science at best—all that was known was that the storm would likely strike the state, but it was unknown where it would come ashore. Military aircraft—Grumman F6F Hellcats, Corsairs, and P-51 Mustangs, among others—were flown from nearby bases and from the deck of the USS *Guadalcanal* to the refuge offered by NAS Richmond's sturdy and cavernous blimp hangars.

The storm came ashore on the mangrove-entwined coast of south Florida, cut a swath across southern Dade County, and tore through Richmond NAS. The hangars, which stood close together and were stuffed with blimps and hundreds of fighters and bombers, withstood the winds. But one of them caught fire, perhaps from a short circuit. Witnesses reported seeing the winds drive flames horizontal, and eventually all three hangars were ablaze, lighting the night sky with burning wood, aircraft, and fuel. When the rain stopped, only the smaller buildings and the hangars' concrete corner pillars were standing.

Crockwell kneels and picks up a few oddly shaped glass beads from the asphalt pad. Others are melted irregularly into the surface, interspersed with a few metal fragments.

"You can really get a sense of how hot the fire was," says Crockwell. "These beads are all that's left of the windows.



Grumman J4F Widgeon



Smoldering remains



Hangar on fire



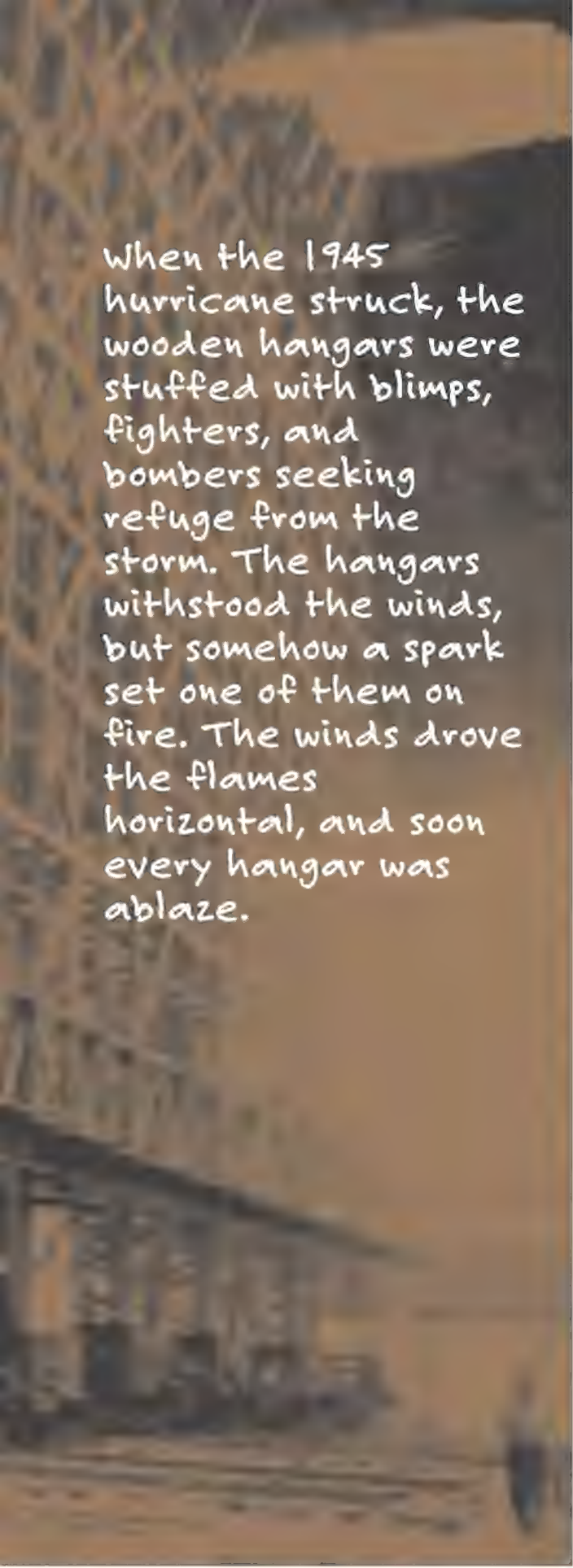
Concrete skeletons

DEPARTMENT OF THE NAVY (5)

We find a lot of other fragments of glass and metal around—pieces of aircraft and airships."

Crockwell motions to the overgrowth next to the pad. "One of the legends of the place is that after the war was over, they dug big pits and pushed the aircraft parts into them," he says. "It's enticing to think that somewhere out here





When the 1945 hurricane struck, the wooden hangars were stuffed with blimps, fighters, and bombers seeking refuge from the storm. The hangars withstood the winds, but somehow a spark set one of them on fire. The winds drove the flames horizontal, and soon every hangar was ablaze.

there may be pits full of World War II aircraft parts. Some of the oral accounts tell us that after the fire, you could buy a P-51 for \$50."

As the Navy cleared the wreckage of the base, a demolition team dynamited the concrete pillars. One refused to fall. Now one of the highest structures in southern Dade County, it's bristling with antennas and is the central relaying station for the area's 911 service. Blimps never returned permanently after the storm, but the base's helium plant continued to supply Navy airships for years. Richmond's other buildings served a variety of uses, such

as providing classroom space for servicemen going to school under the G.I. Bill, and later as space for Naval and Marine Corps Reserve units. The end came in 1992, when hurricane Andrew leveled all except the headquarters and that single, stubborn pillar.

Today, Anthony Atwood and his volunteers hope to give the HQ building its final assignment, as the official all-service military museum and memorial of south Florida. Atwood, a former Navy recruiter on temporary recall at a reserve station, has made the salvation of Richmond's headquarters building and the memory of the blimps and crews that flew here his own crusade, and intends the story of NAS Richmond to be the subject of his master's thesis for an advanced degree in history.

The year before the city of Miami's centennial in 1996, Atwood says, "there was a lot of community consciousness raising, and being a community-activist-type person, I [wanted to organize] a commemorative event at the site of the old blimp base." To honor U.S. servicemen, Atwood put together a ceremony that attracted 300 people and raised an American flag where NAS Richmond's flagpole once stood.

Bolstered by the turnout, Atwood and a core of volunteers set up a display about the base at the nearby Gold-coast Railroad Museum. As the group began to publicize its efforts, members placed on display in the headquarters building artifacts they found nearby, including aluminum fragments from the blimps and structural parts of the hangars. More volunteers came forward, some of whom had been blimp crewmen or had served at the base as civilians, and gradually the idea of restoring the HQ building took hold.

"I'd like to see this as a federal institution—an ongoing museum for young and old alike," Atwood says. "We hope to see a veterans' memorial, nature trails behind the building, and a replica of the Vietnam [memorial in Washington, D.C.] wall."

Before restoration, however, a few problems with the building's location must be solved. Although the Army Corps of Engineers owns both the building and the land around it, nearby land is owned by the University of Miami, which has its own plans for expansion,

and access to the old base is limited. The solution is to raise the building by hydraulic jacks and truck it about 350 yards to a plot of federal land accessible from the neighboring Metrozoo's main entrance road. Atwood has enlisted the help of several Florida politicians, including U.S. Senator Bob Graham and Representatives Carrie Meek and E. Clay Shaw Jr., to steer the project through the competing priorities of a major university, federal agencies, and one of the largest zoological parks in the nation. Mayor Paul Novack of Surfside, a town just north of Miami, has been a key ally. "In this place, the museum would be a natural buffer between the zoo and [nearby] development," Novack says. "And when the building is moved, the land behind it will be restored to a natural state."

"It's just the right thing to do," says Atwood, whose father hit the beach on D-Day during World War II and who has the conviction—and salesmanship—of a military recruiter. Even though negotiations have been long and complicated, they have resulted in what he calls "a strange coalition of environmentalists and military people slightly to the right of Attila the Hun."

Once the officials have inked the deal and the structure is moved to its new home and restored, NAS Richmond's headquarters building—survivor of war and at least five hurricanes—will return to service, reminding its visitors that long before exotic animals roamed nearby, blimps prowled the skies. ➔

*In a hint of the museum to come, World War II Navy veteran Allan McElhiney displays blimp artifacts found in the weeds nearby.*



CARL JUSTE





## *The choicest sites for airplane watching.*

**I** FEEL AT HOME WHEREVER AIRPLANES ARE. When I travel, either in my own airplane or on an airliner, I take a look around the airports at my destination. At major terminals, of course, you're restricted, though you can usually find a good vantage point for watching the activity on the runways. But at smaller ones, if you're not a nuisance, you can quietly explore, looking through open hangar doors, meeting people and their airplanes, and watching them fly. Add a day onto your next trip to seek out a small airport. You'll almost surely see something you've never seen

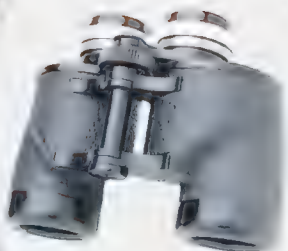
before. Let me introduce you to a few places I've visited recently.

Several years ago on a long cross-country flight in my Piper Super Cub, I saw a curious sight southwest of Spokane, Washington. It was one of those super-clear days that makes you keep checking the chart in disbelief because you can see so much farther than usual. Ahead, two very large airplanes were doing touch-and-go landings on a giant runway in the middle of nowhere. I grabbed my sectional chart. This was either a mirage or Grant County International Airport at Moses





# AIR ports of Call



STORY AND PHOTOGRAPHS BY RUSSELL MUNSON

Lake, a small town in southeast central Washington that is for some reason served by an airport with a 13,503-foot runway. Closer in, I could see they were Boeing 747s going round and round in a tight pattern.

"Grant County tower, Super Cub 7789P."

"Cub 89P, Grant County."

"89P is 15 to the east at 2,500. We'd appreciate traffic advisories, and, ah, what are those 747s doing?"

*A father and daughter get an eyeful at Bayport Aerodrome on New York's Long Island (above). A Japan Airlines 747 does a touch-and-go at Moses Lake, Washington (right).*







*Robin Scott cranks up his Yak-52 at Chino Airport in California for some aerobic practice.*

"They belong to Japan Air Lines. JAL trains here."

I learned that Grant County International was formerly a Strategic Air Command base—Larson Air Force Base—and B-52s flew from that long runway. In fact, Boeing delivered all the B-52s built in Washington to the Air Force at Moses Lake. But as the missile age dawned, some SAC bases

closed. The little town was left with a magnificent but vacant airport. For JAL, however, Moses Lake was the perfect place for its Heavy Jet Aircrew Training Center. The airline has been in town now for 34 years and currently operates a 747-200 and 747-400.

I stop in Moses Lake whenever I'm out that way. I've watched those graceful hippos whistling down the chute in

the rain, at night, and at dawn, big tires screeching against asphalt in billowing clouds of rubber smoke. I've seen the rudder kick way over as the instructor yanks back a thrust lever to simulate an engine failure just as the airplane is poised on its hind feet for takeoff. I can imagine the student stretching his leg hard against the rudder pedal, trying to keep his aircraft straight. Sometimes, both 747s will use opposite ends of the same runway to save time in an alternating ballet of taking off straight out, wracking over into a teardrop turn, and coming on around to land in the reverse direction.

Moses Lake Port Authority has great hopes and big plans for its airport. With long runways and a rural location, Grant County Airport would make a fine international freight hub, according to its supporters, and the Authority recently made a deal in which McChord Air Force Base in Tacoma can use Moses Lake as a training facility for its C-17 Globemaster IIIs. Long-term planners even envision this as a port for space shuttle replacements that can take off and land on conventional runways. For now, though, the 747s are enough to satisfy any airport bum.

*A hangar party cranks up at Chino for residents and fly-in guests.*





**L**OCATED 35 MILES EAST OF DOWNTOWN Los Angeles and just six miles south of Ontario International Airport, Chino Airport was established in 1940 as Cal-Aero Academy. Thousands of U.S. Army Air Forces pilots were trained here by civilian instructors under government contract. It was the first civil school built in the form of an Army post, and was commanded at one time by Captain Robert L. Scott, who later wrote *God Is My Co-Pilot*. Many of the original wooden buildings still stand.

Aviation history is alive in every corner. Over at the Military Aircraft Restoration Corporation—the hangar with the C-123 transport parked out front—you’ll likely run across Joe Krzeminski and coworkers, restoring and maintaining rare aircraft. Krzeminski forms a strong allegiance to the particular history of each aircraft he restores. He’s currently working on a Douglas A-20 Havoc.

A few steps east of the C-123, Tony Ritzman is running up a Douglas A-26, which is flanked by three North American B-25s. Aero Traders, owned by Ritzman and his partner, Carl Scholl, specializes in the restoration of military aircraft from World War II and the period immediately after, primarily piston engine types. The company will also train you to fly them, or rent you a B-25 camera ship and crew for your next air-to-air photography session.

Sam Stewart was sitting in his Martin 404 when I hollered up the rear stairs to see if anyone was home. Stewart has owned ten 404s, but never more than three at once. He and his son, Ted, flew the Doobie Brothers band on this ex-Eastern Air Lines aircraft, serial number 14235, for seven years, through 1985.

You’ve probably heard of the Planes of Fame Air Museum at Chino, and its branch site at Valle Airport in Grand Canyon, Arizona. Planes of Fame, on the north side of Chino airport, started in 1957 as a dream of Edward Maloney. Housed in several buildings, one of which is an original Cal-Aero hangar, Planes of Fame has amassed some 150 aircraft, 30 of them flyable. The collection includes several one-of-a-kind treasures: the only flyable Northrop N9M 60-foot flying wing, the only fly-



*Florida’s Opa Locka Airport is home to a number of vintage freighters; the hills are alive with the sound of old round engines.*

able Mitsubishi A6M5 Zero model 52, the only flyable Boeing P-26 and P-12E, the last surviving Seversky AT-12, and Charles Nungesser’s Hanriot HD-1 Scout. Fighter Rebuilders, the museum’s on-site restoration facility, is also open to the public.

On the last afternoon of my Chino visit, I walked among the rows of T-hangars at the northeast corner. “Hangarminiums” would be more descriptive—some have kitchenettes, bathrooms, couches, and shops, as well as space for both winged and wheeled machines. In his hangar, paleontologist Michael Stokes has his office as well as his Cessna 140, his 1942 Dodge WC54 military ambulance, and his hangarmate’s Luscombe. Archie Lane’s head was in the wheel well of his Beech D-17S Staggerwing when I passed by—the airplane will be back in the air very soon, he said. One hangar row away, Robin Scott had parked his 1957 Ford Thunderbird and was cranking up his bright red Yak-52 for some aerobatic practice. A Fouga jet trainer, with its unique butterfly tail, taxied by Dave Hansen’s hangar party. Friends



had parked their airplanes nearby, and an excellent band played Glenn Miller favorites.

**F**ROM THE SUNNY SOUTHWEST I TRAVELED to the sunny southeast and Opa Locka Airport in Florida, a scant eight miles north of Miami International. I came here for three reasons, and they all begin with DC: DC-3, DC-6, and DC-7. Florida Air Cargo has four DC-3s and two Beech 18s. On the adjacent ramp, Florida Air Transport flies the sole DC-7 in commercial service. Its DC-6 is almost ready to go on the line. Both companies fly the old radial engine airplanes for profit, not nostalgia. But the thundering relics are unlikely to remain economically viable much longer when pitted against the costlier but far less maintenance-in-



tensive turboprops like the Shorts 360.

Paul Kupke runs Florida Air Cargo. He has been through a tornado, blown engines from fraudulent overhauls, and endured a host of other Aviation Economics 101 realities. Kupke started flying freight to the Bahamas in 1994 with one DC-3. "You have to do everything yourself," he says, "all your own maintenance, flying, and freight forwarding. Otherwise, you're not going to make any money." Kupke gives his DC-3s five years or less of profitable life. "Insurance premiums on a Shorts 360, for example, are half what they are for a DC-3, even though the Douglas hull value is \$175,000, compared to \$1.4 million for the Shorts," he says. "Mechanics for radial engine airplanes are getting very difficult to find. Overhauling a Pratt & Whitney 1830 on the DC-3 used to cost \$18,000; now it's \$45,000. And the maintenance time per flight hour for a DC-3 is much higher than for the Shorts. You could operate two Shorts with one mechanic. Two DC-3s require three mechanics. Used to be DC-3s were so cheap you could have them sitting around to be used when needed. No more. Finance payments are higher on the more expensive Shorts, but you can fly those PT-6 engines all day long, every day, with very little maintenance." But doesn't he just flat out love the DC-3? "Oh yeah," he says. "It is a great airplane. It's fun to fly, and when it's running good, I love it. When it's broken and I have a load of freight on the ramp, I hate it." This day, as a matter of fact, Kupke was leasing a Shorts 360 as a trial.

Martin Gomez and his sons started flying their DC-7 about two years ago as Florida Air Transport. The airplane was a derelict at Opa Locka when they bought it. Gomez knows old transports and round engines. He began his career as a mechanic with Avianca in Colombia, moved to the United States in 1964, and has worked on the old beasts most of the time since. His children have grown up with aviation. Son Carlos runs the office, and son Walter is chief of maintenance. One or the other also flies as flight engineer on weekly freight trips to the Bahamas.

The DC-7 and a recently acquired DC-6A freighter were parked on a ramp leased from the county when I visited.



*A Stearman takes center stage at Bayport, aiming for the grass runway.*

Sitting between the two stately airplanes was the Gomezes' parts van. All maintenance is performed outdoors by Walter, his father, his uncle, and the rest of the ground crew. Hangar space would be prohibitively expensive. This DC-7B, serial number 44921, still carries the same registration, N381AA, it did when delivered new to American Airlines in 1956.

"That's a beautiful airplane," I said to Carlos while we were standing by the DC-7. "You want to buy it?" he asked, laughing. Like Paul Kupke, Carlos and Walter have an intimate knowledge of piston-engine airplane economics. "Everyone laughed when we bought the airplane," he said. "It's not easy, but we make it work by doing everything ourselves. When we're not flying it, we're working on it."

"Why do you do it?" I asked.

"We've been in aviation since we were kids," Carlos said. "We know the airplane's special niche. The DC-7 can carry 35,000 pounds of freight into a 5,000-foot strip in the islands. The runways aren't going to get any longer in most of the places we fly, because they end at the water. Right now, and probably for another few years, these airplanes are the most economical way for us to serve that market. Time's running out, though. Then it's on to the next gig. I'd love to just restore old transport aircraft, but I've got to make a living."

On Tuesday morning, the day before the scheduled run, Walter was in the cockpit cranking the uncowed number-two engine for a ground check. The prop was turning so slowly it seemed

like it could never catch, but it did, chugging, one cylinder after another exploding, belching smoke, shaking, and then settling into a smooth idle. After the oil had warmed up, Walter increased the power. The 18-cylinder Wright R-3350 Cyclone wrapped into a serious roar unlike the sound of any other airplane at the airport, and the airplane rocked back and forth in its chocks.

It was still dark Wednesday morning when the DC-7 took off for the Bahamas, all four full-throated engines turning as smoothly as the day they were born. George Riley, about the same age as the airplane, was in the left seat today. "I gave up flying a DC-8 and an apartment in Paris to come fly this thing," he told me.

Martin told me the -7 was due back around 2 p.m., so at 1:30 I waited outside the airport fence on the approach to runway 27 Right. Sure enough, at 1:55 there it was, an unmistakable elegant shape, still too far away to hear. As it grew larger, gear down and full flaps, I could hear those engines, the same stirring, throttled-back rumble I heard often as a child at the airport fence in Denver.

**B**AYPORT AERODROME IS A 2,740-FOOT grass strip 50 miles east of New York City and four miles south of Long Island MacArthur Airport. This rare airport would have been a housing development years ago had it not been for Peter Cohalan, an enlightened Islip Town supervisor, his board, and local citizens. A developer was set to begin bulldozing, but the neigh-



bors decided they would rather have an airport next door than yet another development. Would that all airports were so fortunate.

My connection with Bayport began 33 years ago. The first owner of my 1962 Super Cub was the Long Island Soaring Association, based at Bayport, then called Edwards Field. When the club was trading the '62 in for a new Cub in 1967, I bought it. The airport has hardly changed since, except for two new rows of metal T-hangars on the northeast end of the field. A small museum and some beautiful aircraft live in those hangars; among them are Cubs, Stearmans, a 1931 Aeronca C-3, an Aeronca Champ, a Fleet 16B, an N3N-3, and a rare Waco UBA, one of six known to have been built. On almost any nice weekend some of them will be flying.

D'Angelone Aviation, the fixed-base operator, is owned by Frank D'Angelone, who 30 years ago was my commercial and multi-engine instructor. D'Angelone, an FAA-designated examiner, is an affable man who loves to fly and teach. Affable, that is, unless you operate an airplane in a sloppy manner. Bayport is surrounded on all sides by trees and lies underneath MacArthur's busy airspace in a special corridor. Since there is not much room for error, it is best to call ahead or drive by for a briefing if you haven't landed there before.

Steve Martin (not the actor) was giving rides in his Fleet biplane every time I stopped by Bayport. "I hung around airports as a kid," he told me, "but no one ever gave me a ride. I made up my mind then that if I ever had an airplane, I would give anyone a ride who asked." His brightly colored Fleet, with "El Conquistador del Cielo" painted on the side, is popular indeed.

With no commercial traffic, there are no security gates or tall fences. Bayport says "come in," not "keep out." Children, properly supervised, are welcome to watch the airplanes come and go and see them up close. I didn't meet a pilot there who wouldn't be happy to chat or answer a visitor's questions. After all, that's probably how they got started: kids at airport fences who grew up and stepped inside. —

## Honorable Mentions

### **Anchorage International Airport Anchorage, Alaska**

If you can take your eyes off the Anchorage scenery, you'll see the DC-6s of Northern Air Cargo, and, out on Lake Hood, floatplanes in summer and ski planes in winter.

### **Los Angeles International Airport Los Angeles, California**

Watch airliners approach from the Proud Bird Restaurant on the southeastern end of the airport (look for replica warbirds on poles) and use the restaurant-provided headphones to eavesdrop on air traffic control.

### **Mojave Airport, Mojave, California**

The joint is jumpin' at the Civilian Flight Test Center. Watch KC-135s, a five-engine 747, F-4 drones, an A-300, an L-1011, and a DC-10, and the aircraft of the National Test Pilot School: an Aermacchi MB 326 jet trainer, a deHavilland Dove, a Morane-Saulnier MS760A Paris Jet, and a Saab S/SK-35XD Draken supersonic jet fighter. Added bonus: Burt Rutan's Scaled Composites high-altitude, long-endurance twin-jet, Proteus, as well as whatever other unconventional design Scaled might be working on at the moment. Airport manager Dan Sabovich invites visitors to watch the goings-on from the airport tower.

### **Flabob Airport, Riverside, California**

An airport with a long history, a 1930s feel, and a community of general aviation, homebuilt, antique, and classic aircraft—and a good café. Home of the Experimental Aircraft Association Chapter One.

### **San Diego International-Lindbergh Field, San Diego, California**

Watch 737s, 757s, DC-9s, and military traffic from the Windsock Bar and Restaurant terrace at Jimsair Aviation Services.

### **Santa Paula Airport, Santa Paula, California**

Antique, classic, and sport aircraft abound at Santa Paula, a hive of tailwheel activity. A fly-in/aircraft display is held the first Saturday of each month. The Logsdon restaurant overlooks the runway.

### **Dover Air Force Base, Dover, Delaware**

Visit the Air Mobility Command Museum between the two active runways at this Air

Military Command base and get a good look at the mammoth C-5 Galaxies in slow flight.

### **Reagan Washington National Airport, Washington, D.C.**

Take the George Washington Parkway to the Gravelly Point exit and park in the lot designed for boat launchers but littered with airplane watchers. When the wind is out of the south, traffic will be landing directly over your head on Runway 18. You may hear wingtip vortices, which sound like luffing sails.

### **Miami International Airport, Miami, Florida**

Almost any time of day and into the night, there's a line of cars parked along Perimeter Road, adjacent to Miami International, watching airliners and cargo aircraft come and go. Take 836 to the Red Road exit (also known as NW 57th Ave. or 959). Go north and exit by the 94th Aero Squadron Restaurant on Perimeter Road, which has an airplane-watching lot. Have Sunday brunch at the 94th, which overlooks the runways.

### **Watson Island Seaplane Base, 1000 MacArthur Causeway, Miami Beach, Florida**

Watch Chalk's Ocean Airways' Grumman Turbine Mallard amphibians, inbound from Fort Lauderdale and the Bahamas, splash down off Miami Beach.

### **North Las Vegas Airport, Las Vegas, Nevada**

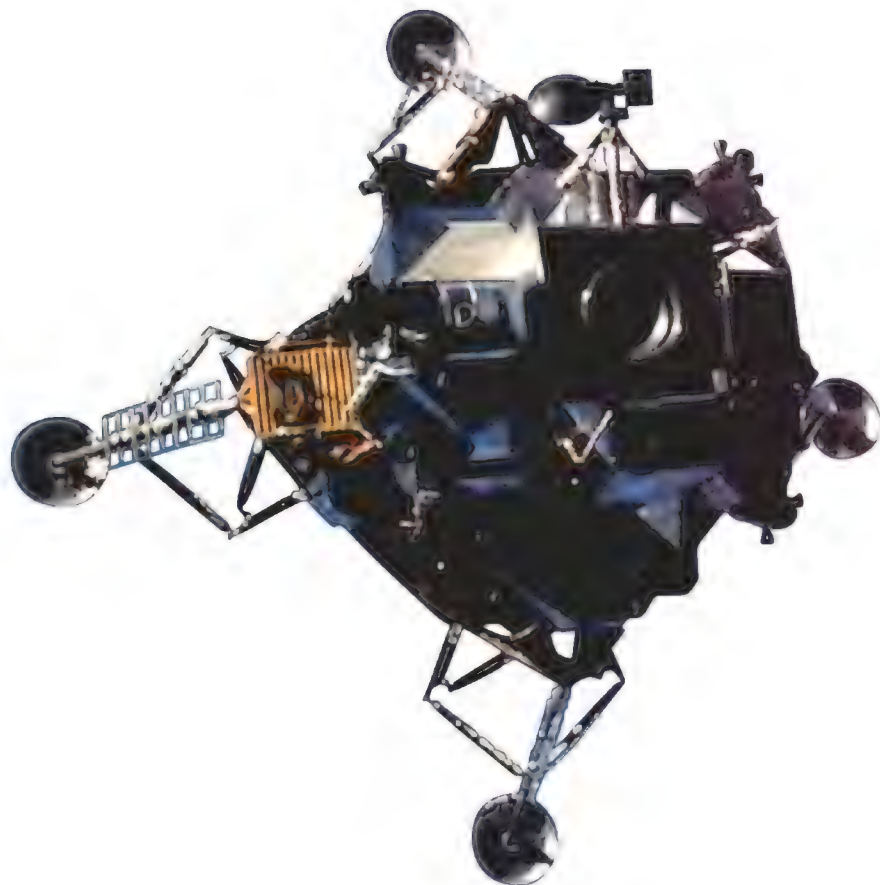
Enjoy a cold one on the veranda of the Flight Deck Restaurant and watch blimps, homebuilts, airliners, student pilots, helicopters, Twin Otters, and F-16s, which fly in and out of nearby Nellis Air Force Base.

### **Smyrna Airport, Smyrna, Tennessee**

Fourteen miles south of Nashville Airport, Smyrna, with its 8,000-foot runway, was the site of a World War II training center for B-24 and B-17 pilots. Today, you can sit in Smyrna Recreation Park, right across the street, and watch everything from Cessna 152s to DC-8s. The airport also serves as an Air National Guard training facility for C-130s and C-141s and an Army National Guard helicopter unit. And it shares the airport fence with the Smyrna Municipal Golf Course. Fore!

A complete list? That's impossible. Almost any airport has something or someone worth watching. Bring binoculars, camera, and a smile. You never know what you'll find.





NASA

"THE OLD CLIMATE ORBITER WASN'T PRETTY BUT IT GOT THE JOB DONE"

# We Called It / THE

*by D.C. Agle*



The commander of the Challenger was in the zone, which was remarkable, considering his predicament. After all, he was piloting from a standing position. He was only 44 inches away from his crewmate but forced to speak to him through an intercom. And finally, he was peering through a bubble of Lexan, a pane of Chemcor structural glass, a sheet of Vycor meteorite-stopping glass, and around a hundred layers of infrared, thermal, and anti-fog coatings at a vista no other human had ever seen.

There, through Apollo 17 commander Gene Cernan's small triangular window, the virginal, rolling, cratered Valley of Taurus-Littrow was unfolding before his eyes. But for Cernan and lunar module pilot Harrison Schmitt, the mountains, craters, and massifs were more than a remarkable panorama; they were signposts pointing the way to a landing zone that NASA scientists had selected on the southeastern shore of the moon's Sea of Serenity.

"There it is, Houston!" Cernan's voice crackled over NASA's communications loop. "There's Camelot Crater. Wow! Right on target."

Two hundred and fifty thousand miles away from the evolving final mission of Project Apollo, the men and women of Grumman Aerospace listened intently as the two astronauts put the lunar module through its paces. To them, the crew sounded like a well-oiled machine, and perhaps more importantly, the machine the crew was flying was matching the astronauts beat for beat. The Apollo lunar module was a Grumman design, and Apollo 17 was to be the company's extraterrestrial swan song. But while the landing of 17 would be a crowning achievement for all "Grummies," as NASA employees sometimes referred to them, for two smaller groups of Grumman employees it was the opportunity to settle a bet.

"The question was: Would anybody ever let the autopilot actually land the vehicle?" says former Grumman test pilot Tom Gwynne. "The [Grumman] pilots had bet a case of champagne with the engineers that nobody would actually let the autopilot land the lunar module. The engineering perspective was: The digital autopilot can do the best job, so why wouldn't you? And the pilot perspective was: You have got one shot at it; what are you going to tell your grandchildren—that you let the autopilot land you on the moon?"

With 300 feet to go, the *Challenger's* digital autopilot was still engaged and

# BUG!



the engineers appeared to be winning the bet. It was December 11, 1972, a decade, a month, and four days since a fledgling NASA had placed a wager of its own. NASA had bet that a Long Island-based company known mostly for building capable but stout and somewhat unsightly aircraft for the U.S. Navy could build humanity's first true spacecraft. (Such vehicles as NASA's Mercury space capsule and the Soviet Vostok also flew in the vacuum of space, but unlike the LM, they were designed to meet the aerodynamic requirements of flying through Earth's atmosphere during reentry.) "We got the contract in November of 1962," says Thomas J. Kelly, Grumman's chief engineer on the lunar module. "We had never built a manned spacecraft before. Nobody was an expert in those days, and they asked us to build a vehicle to land a man on the moon."

NASA asked for a Lunar Excursion Module. "Then they changed the name," says Kelly. "Somebody at NASA decided 'excursion' made it sound too flaky, so they changed the name to just plain old 'lunar module.' It was the easiest modification we made during the entire program."

Changes came fast and furious in the early days of the LM. The original Grumman design called for a 22,000-pound, two-stage vehicle: a descent stage with five fixed landing gear that would carry the astronauts to the moon and an ascent stage that would power them back into lunar orbit. As far as piloting, designers rationalized that flying to the moon should be as much like a helicopter ride as possible, so they strapped the astronauts into two 75-pound seats and had them looking for acceptable landing spots out four huge, helicopter-like bubble windows.

But even the most junior aeronautical engineer back in 1962 knew that windows cause thermal, structural, and weight problems. The windows would have to get smaller. Still, there was no getting around the requirement that astronauts had to see where they were going. Then some bright bulb at NASA or Grumman (nobody recalls exactly who) realized that just because pilots always flew sitting down in the atmosphere did not mean they had to fly that way outside of it. (The closer



*A multiple exposure captures the movement of the Lunar Excursion Module Simulator, a rocket-powered vehicle that astronauts used to familiarize themselves with the handling characteristics of the lunar module.*

an astronaut's face is to the window, the greater his field of view, and a standing astronaut can position his face much closer to a window than a seated astronaut can.) Studies showed the astronauts would not encounter more than one third of Earth's gravity during the flight of the LM. The result was that the astronauts would now stand side by side at a distance of 16 inches from a pair of two-square-foot windows. The new configuration gave them a 20-times-greater field of view from one-tenth the window area.

By October 1964, after almost two years and a mountain of engineering drawings, Grumman had a good idea what its now-33,000-pound lunar lander would look like—like no flying machine anybody had ever seen before. "You have to remember that the LM was carried in the Saturn's protective shroud and only operated in the vac-

uum of space," says Kelly. "That allowed us to design it from the inside out because we had no concerns for aerodynamics at all, which resulted in the distinctive look for the LM."

But what was for engineer Kelly a "distinctive look" was something else for the aviators who would fly it. "My first thought was that the thing was Godawful," says Apollo 14 lunar module pilot Ed Mitchell. "Although I knew exactly why it looked the way it did, I still couldn't help but think...yuck! I mean, I was a fighter pilot and used to aerodynamic as well as aesthetically pleasing high-performance jets, and here I am looking at this...this...thing."

"We called it 'the Bug,'" says Gene Cernan, the mission commander on Apollo 17. "And to me it looked like some gigantic monster that was gonna hop down New York City just gobbling up society."



# A Daring Dress Rehearsal

The lunar module was the Apollo program's big unknown. Data from the [Apollo 5] unmanned flight looked good, but the LM lacked the assurance that comes from having sharp-eyed astronauts living aboard it in space—flying, probing, noticing every detail of its in-flight performance. The LM would get its second chance to fly in space with the March 3, 1969 launch of Apollo 9. It would be an ambitious 10-day mission with the goal of performing in Earth orbit the entire sequence of events required on a lunar mission, except for the actual landing.

It was our Grumman support team's first direct experience with astronauts on a real mission, and I found it exciting that men whom I knew were up in space flying our machine. The giant three-stage Saturn V booster lifted off on schedule and performed flawlessly, placing the spacecraft into exactly the planned Earth orbital altitude. The critical maneuvers of command and service module (CSM) separation from the spacecraft/LM adapter, and rotation and docking to the LM, went perfectly. After six hours of checking out the CSM and its systems, [commander James A.] McDivitt fired the service propulsion system, and the powerful rocket engine boosted the heavily laden CSM-LM combination into a higher orbit. He sounded relieved that the dormant LM was still there after the force of the first burn. Following these operations the crew settled down for a meal and sleep. I took advantage of the quiet time to hand over my Mission Control watch to a colleague.

I was back to Mission Control early the next morning, listening to the crew puffing as they donned their spacesuits to enter the LM, which they had named *Spider*. The crew channel went dead. We did not learn until the postflight briefings that [lunar module pilot Russell L.] Schweickart had vomited. After some delay he entered the LM and flipped dozens of switches to activate its systems. He commented that the LM was quite noisy, particularly its environmental control system. McDivitt joined him, and after they unpacked the television camera in the LM cabin we watched them on worldwide TV. Our friend McDivitt promptly embarrassed us by pointing out to the world a washer and other bits of manufacturing debris floating through the cabin under zero gravity. It was a chastisement we deserved, and it motivated us to still more stringent efforts to clean the cabin and all closed compartments of the LM during assembly and test.

McDivitt and Schweickart extended the LM's landing gear, which locked smartly into place upon command. They checked

out the LM's systems and fired the LM descent engine for more than six minutes at full thrust while in the docked condition, simulating much of the powered descent burn that would be required to bring the LM down from lunar orbit for landing. When McDivitt and Schweickart rejoined Dave Scott in the command module, they felt that their LM would be up to the challenges ahead.

The fifth day in orbit was the crucial part of the mission for the LM—the demonstration of the LM's flight maneuverability, and its ability to rendezvous in orbit from a far distance. My colleagues and I scrutinized the instrumentation readouts on our consoles carefully as the crew reactivated *Spider's* systems.

Hundreds of pressure, temperature, voltage, current, and other measurements located in all the systems were sampled several times a second, giving us detailed real-time information on the LM's health and performance. With all systems activated, *Spider* looked good to the crew, to the flight controllers, and to me. Over the net came Flight Director Gene Kranz's crisp voice: "Apollo 9, you're go for LM sep" (lunar module separation).

No longer joined at the head to the command module *Gumdrop*, *Spider* cavorted briefly, testing her reaction control system, and then pirouetted slowly before *Gumdrop's* windows, preening for Dave Scott's inspection. He pronounced her beautiful. After 45 minutes of maneuvering within three miles of

*Gumdrop*, McDivitt fired the descent engine, putting more distance between the two spacecraft. Subsequent firings increased the separation distance to over 110 miles, where the pilots could no longer see each other's spacecraft. *Spider's* crew then separated the ascent from the descent stage while igniting the ascent engine in an orbital simulation of lunar liftoff, and

successfully completed orbital rendezvous with *Gumdrop*.

*Spider* performed so consistently well that I never felt any apprehension as I watched each critical event of the mission click off like clockwork. I could hardly believe that this agile machine, dancing so gracefully through space, was the same crotchety beast with the broken wires and structural cracks that had given us fits for over two years of ground testing. Was our LM design and construction really good after all, or were we just lucky? I was not sure, but thought it was some of both.

—from *Moon Lander: How We Developed the Apollo Lunar Module*, Thomas J. Kelly, © Smithsonian Institution Press, 2001.



NASA

Tom Kelly (below) designed the LM as a two-stage vehicle (left, in the Bethpage factory).



A Grumman publicity photograph was set up to emphasize how light the 85-pound ascent-stage fuel tank was (right).



NORTHROP GRUMMAN (2)



Looks aside, the LM was the astronaut corps' one and only way down to the lunar surface and off. With so much at stake, Grumman's factory in Bethpage, Long Island, became a familiar stop on many an Apollo astronaut's weekly itinerary. Since time was the most valuable commodity in the Apollo program, NASA spared no expense in getting the astronauts to and from Bethpage. "I would sign out a T-38 [a supersonic jet trainer]," remembers Mitchell, "and fly it from Houston up to Calverton Field on the tip of Long Island. Then I'd grab a smaller jet, a T-33, and fly that down to the airport on Grumman's site."

By 1966, visiting astronauts found Grumman's Plants 5, 25, and 30 overflowing with 7,500 personnel, 3,000 of them engineers who were well on their way to cranking out by hand more than 50,000 technical drawings for the LM. For each module, it took six months

to go from drawing blueprints to bending metal, and another two years to test each vehicle. For astronauts, engineers, craftsmen, and technicians alike, the LM experience was long hours, tremendous pressures, and a payoff that was years down the road.

"During testing, the hours were very sporadic," says Apollo 13 LM pilot Fred Haise. "On many occasions I'd be in the LM cabin working on a test and things would not be working smoothly. Then there would be a stop and the test engineers would decide whether to proceed. If I thought it was going to take a while, I would leave the LM and go back to a trailer we had nearby and try to take a nap. If I thought it was going to be a short delay, many times I would just lay on the floor of the LM and go to sleep. Later, I figured that over the 17 months I worked at Grumman, I probably slept 30 days' worth in the LM."

**C**hALLENGER was orbiting the moon at a speed of 4,563 mph and an altitude of 40,700 feet, and things were about to get a lot more interesting. Cernan launched computer program P-63 to begin the Powered Descent Initiation. When P-63 flashed on the LM's little green electro-luminescent computer display and the main engine kicked in, an LM crew knew they were approximately 260 miles and 12 minutes of computer crunching away from the moon's surface.

In the moment prior to PDI, *Challenger* was on its back, windows pointed heavenward, its big and—for the moment—silent main engine pointed in the direction of orbital motion, the direction *Challenger* was headed.

Inside the lunar module, the astronauts were in full spacesuits, including helmets and gloves. They were surrounded by 12 instrument panels on which were arranged 158 switches, 16

## The Soviet Lunar Module

**T**hey were the first to fly a satellite, a man, and a woman into space. So in the early 1960s most were betting that the Soviets would also be the first to land a man on the moon. That man was supposed to be Voskhod-2 spacewalker Alexi Leonov. His machine was the *lunniy korabl*, or lunar cabin (right).

Due to the payload limitations of the N-1, the Soviet moon launcher, Leonov's lunar cabin weighed in at only 12,257 pounds, one-third the weight of the Apollo lunar module. With the scales of rocket science already tipping against them, the Russians were forced to delete many cosmonaut-friendly features from the LK, like a docking tunnel between the Soyuz mothership and the LK lander, separate descent and ascent stages, and one other thing—a second cosmonaut.

That's right, after flying into lunar orbit with a comrade, Leonov was to spacewalk from the Soyuz to the LK, power up and pressurize the cabin, and fly the spacecraft on to the moon all by his lonesome.

And even in the out-of-this-world world of lunar landings, the ride from lunar orbit to the surface promised to be exceptional. After separation from the Soyuz, the LK's



computer would fire a booster stage that would plunge the LK like a cannonball toward the moon. At 4,921 feet the computer would jettison the booster and fire up the LK's throttleable main engine. "It was a pretty gutsy way to do things," says Apollo 11 pilot Buzz Aldrin. "But there is a lot of merit to it also. The handling characteristics of the spacecraft would be much better because you have a lighter-weight vehicle."

Improved handling or not, peering through the circular landing window, and with the clock ticking on his extremely limited fuel supply, Leonov would certainly have had his hands full. "When I saw the moon's surface on the screen," says Leonov, "I would have only three seconds of hover time to decide where to land. Then I had to proceed with the landing. Difficult, but after many training sessions it was enough. It could be done."

If Leonov had managed to land the LK safely, his stay on the surface would have been measured in mere hours: just enough time to plant the hammer and sickle, deploy an extremely limited array of scientific instruments, and grab some rocks. Then the Hero of the Soviet Union would have fired up the very same engine that landed him on the surface and rocketed into orbit to join up with the Soyuz mothership.

The LK was tested unmanned in Earth orbit in 1970 and 1971. But due to ongoing problems with the N-1 launcher (they tended to explode) and lack of political payoff (the U.S. had already won the moon race), the remaining LKs were relegated to Russian museums and the program to the roll call of also-rans in space history.



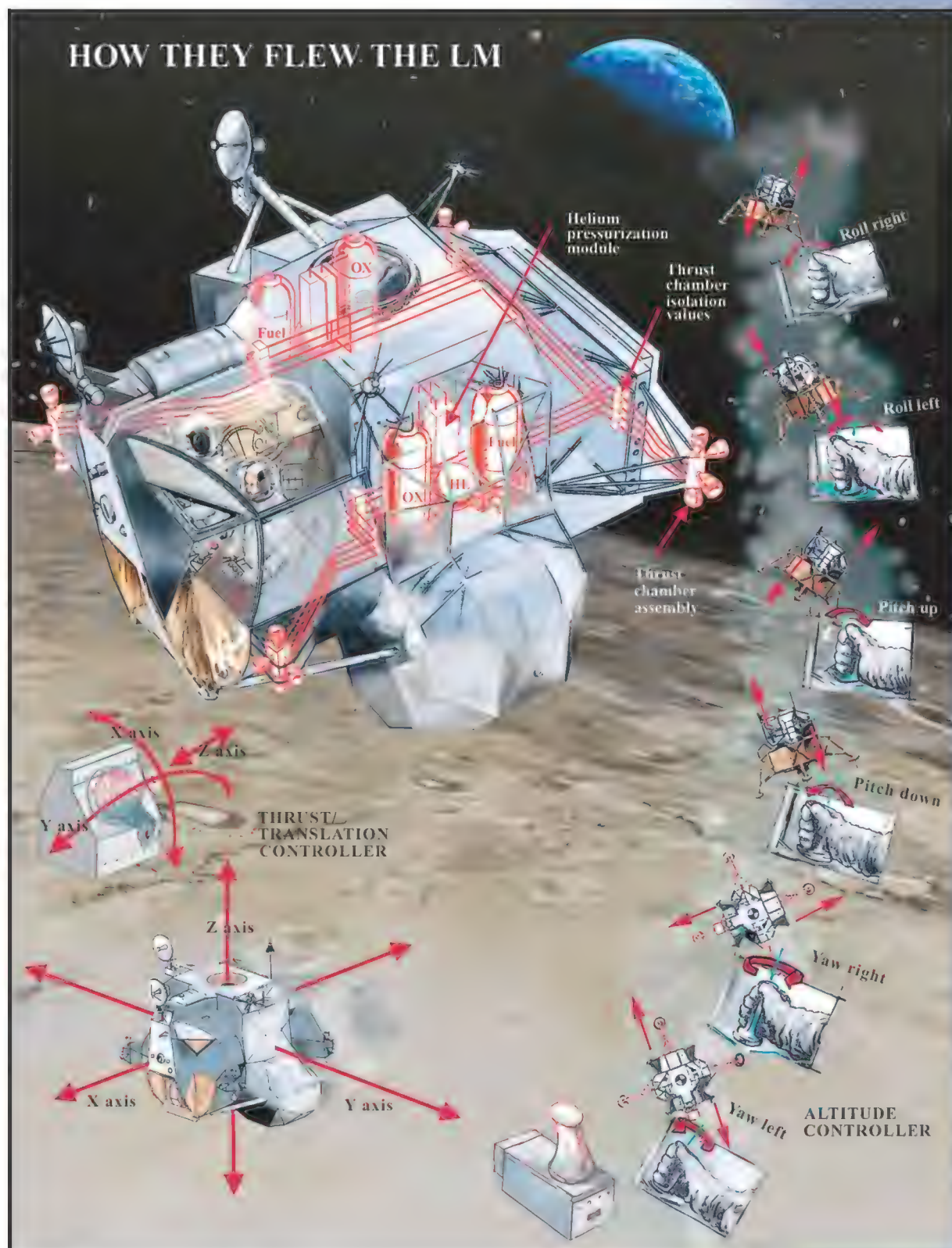


Alan Shepard trained for Apollo 14 at the Lunar Landing Research Facility in Hampton, Virginia.

variable controls, four hand controllers, two computer keyboards, and a mosaic of changing and fixed numeric displays. To work efficiently in zero gravity, they were restrained from floating around the LM cabin by elastic cords that were fastened to the floor of the LM at one end and hooked onto the sides of each spacesuit at waist level at the other. Of course, they couldn't go far anyway in the LM's crew compartment, which measured 92 inches in diameter by 42 inches deep.

Along with the two astronauts inside the LM, there was a third "crewman." Dubbed "Pings" by the astronauts, the Primary Guidance and Navigation Section (PGNS) was the first digital autopilot in a manned spacecraft. With PGNS driving, the astronauts were relieved of some of the more monotonous and labor-intensive flying duties and thus were free to monitor the instruments and observe the moonscape. They could, however, take over manual control when expedient or necessary.

At a given moment, planned months in advance and 250,000 miles away by a roomful of men with thick-rimmed glasses and slide rules, PGNS opened an array of valves, allowing two of the most corrosive chemicals on earth, unsymmetrical dimethylhydrazine and nitrogen tetroxide, to rush through fuel and oxidizer lines with the full intent



After the ascent stage lifted off the moon's surface and into lunar orbit, the LM astronauts used two flight control systems to maneuver themselves into position for docking with the command module: the thrust/translation controller assembly and the attitude controller assembly. The LM pilot used the TTCA to alter velocity and the LM's position from front to back, side to side, and up and down. The attitude controller, on the other hand, was employed to change the LM's attitude in pitch, roll, and yaw.

of obliterating each other on contact. The controlled annihilation took place in the descent engine's combustion chamber.

For the first 26 seconds, the engine fired at only 1,280 pounds, 10 percent of potential thrust. With commander and LM pilot looking on like mother hens, PGNS checked engine performance and gimbaled the descent en-

gine to fire through the ship's center of gravity. Then the first rocket engine that could be throttled in space kicked into high gear.

"At first you don't feel much of anything," says Cernan. "But 26 seconds later, when the descent engine went to full throttle, it was like a booming growl and the vibration felt like big wheels churning beneath your feet."



The LM began to bleed off the forward momentum that had kept it in lunar orbit. Within seconds the astronauts were below orbital velocity. If there was an emergency now, if the PGNS went crazy or the descent engine failed, their crewmate in the Apollo command module could not descend to save them, as he could have if they were orbiting above an altitude of 40,000 feet. The LM crew would now have to work it out for themselves.

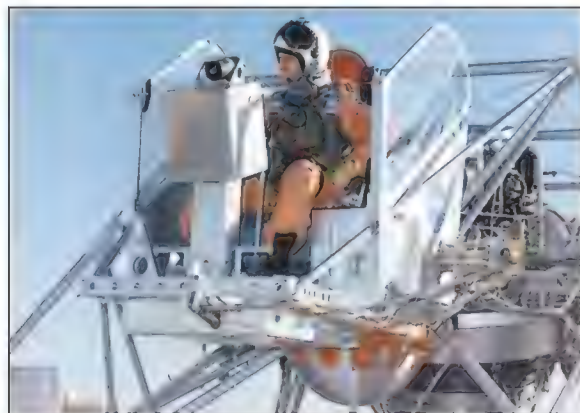
Back in Houston, controllers monitored the descent. Had tracking data indicated that the LM was veering away from the planned landing site, they would have transmitted new coordinates for the astronauts to load into the computer. Even without Houston's input, PGNS could compare the LM's position to the mission flight plan programmed into its memory and issue corrective throttle and steering commands if needed.

During P-63, the majority of the rocket firing came from the descent engine. But with sloshing fuel making up more than half the entire weight of the LM, things had a tendency to get out of sorts. To fine-tune the LM's attitude, PGNS called upon 16 small 100-pound-thrust motors mounted on the ascent stage in clusters of four. Called the Reaction Control System, or RCS, the little thrusters, when used in various combinations, rotated the LM about any axis and performed small translational (left-right/up-down/forward-aft) adjustments in any direction. When the RCS fired, the astronauts couldn't miss it. "The skin of the LM was so thin," says Apollo 10 commander Tom Stafford, "and the thrusters were right there in front of you. If you want to simulate flying a lunar module, take a washtub, put it over your head, and have a kid bang on it with a hammer."

While the RCS was hammering away at the LM and its occupants, the LM's landing radar was calling out to the moon. Four minutes and 55 seconds into the PDI burn, the moon answered. Microwave beams pulsing out of the *Challenger's* landing radar provided the first direct contact between Apollo 17 and the lunar surface. With no appreciable atmosphere, LM crews could not rely on air pressure readings to provide altitude and airspeed in-



*The Lunar Landing Research Vehicle, flown by test pilot Joe Walker (below), was powered by a gimbal-mounted turbofan engine.*



*The LM cockpit was just wide enough for two astronauts to stand side by side in front of two triangular windows. The information displays and flight control panels were either shared or duplicated at both work stations.*

formation. Landing radar was so vital that NASA issued a mission rule: If you don't get radar lock-on by 10,000 feet, abort. The LM astronauts would have aborted by separating from the descent stage, firing the ascent stage engine, and climbing to an orbit in which they would be able to dock with the command module.

Five of the six Apollo moon landing missions did not have a problem getting good radar data at an altitude of over 35,000 feet. But on Apollo 14, the radar had not yet kicked on and mission commander Alan Shepard was not happy. "They called up and said, 'Your landing radar is not working,'" said Shepard in a 1998 interview. "We said, 'Thank you very much, we're aware of that.' And then a little bit further on they said, 'You know what the ground

rule is, if you're at [10,000] feet.' Well, yeah, we knew that. Finally, some bright young man [in mission control] said, 'Hey, your landing radar is working, but it's locked to infinity. Have them pull the switch, reset it, and see if it works.' So we pulled the circuit breaker, put it back in, and sure enough the landing radar came on."

If there was no abort, the astronauts were ready for the approach phase, which was handled by computer program P-64 and initiated at an altitude of 7,515 feet above the moon's surface. Traveling at a horizontal velocity of 506 feet per second and a vertical velocity of 145 feet per second, the astronauts were now ready to take their first real gander at their landing site while continuing to reduce forward and vertical velocities to near zero.







*Neil Armstrong, training for Apollo 11 (above), steered the LM Eagle past huge boulders before making the first moon landing.*

They had to quickly locate important landmarks like large distinctive craters, specific mountain ranges, and rilles—cracks in the moon’s crust.

On Apollo 15, after astronauts David Scott and Jim Irwin began P-64, they found themselves heading for the wrong location. “As we pitched over and I looked out, there were very few shadows as far as craters go,” said Scott in a 1971 crew debriefing. “I measured my east-west displacement by my relative motion to the rille, and I could see we were in fairly good shape, relative to the rille, but we were south.”

Landing in the correct location came in a close second to landing safely at all. If a moon crew was forced to land an appreciable distance from its intended target, a mission’s entire scientific objective could be compromised. The mission that ended up farthest from the target was Apollo 11, at a whopping 4.2 miles. But on that mis-

sion, which was the first moon landing, planting the flag and grabbing any moonrock were plenty good enough. On every subsequent Apollo mission, however, the landing point made all the difference.

If an LM commander was not happy with his spacecraft’s destination, he could change the LM’s trajectory by working a three-axis, pistol-grip controller in his right hand called the Attitude Controller Assembly. Like many controls in the LM, the controller assembly had more than one function. In orbit as well as closer to the moon’s surface, the astronaut could change the LM’s attitude in pitch, roll, and yaw with the controller. But during the approach phase, an astronaut could click the same assembly up, down, left, or right, incrementally changing the spacecraft flight path one degree laterally, up-range or down-range. The astronauts called it “redesignation.”

“I redesignated immediately four clicks to the right,” stated Scott. “And then shortly thereafter, after [Irwin] called me again with the numbers, I redesignated two more right and three up-range.”

Scott ended up making a record 18 redesignations, which collectively moved the LM’s landing 1,110 feet up-range and 1,341 feet north. When he landed, they were all of 2,000 feet from their intended touchdown spot, well within mission parameters.

The reason the LM pilot called out flight information for his commander was that the moon landings occurred before head-up displays had been invented. So on Apollo 17, one of Schmitt’s numerous jobs was to act as a human head-up display, feeding Cernan the rate of descent and altitude calls.

Schmitt: “Thirty-one feet per second, going down through 500. Twenty-five feet per second through 400. That’s a little high, Geno.”

Cernan: “Okay.”

Within seconds *Challenger* reached “low gate,” the point for making a visual assessment of the landing site to select either automatic or manual control. If the road looked clear, if the LM’s auto-targeting would make a safe landing, would Cernan let it do its job? Prior to Apollo 13, Jim Lovell asserted that if PGNS was heading for an acceptable landing spot, he would allow it to land the LM. But that was four missions and one abort ago. This was



Apollo 17. The final mission. Back on Earth, Grumman's engineers were minutes away from a case of the good stuff.

Schmitt: "Three hundred feet, 15 feet per second."

Cernan: "Okay, I've got P-66."

With those four words, the last commander of the last Apollo moon mission took over manual control of the landing of the lunar module. (P-66 was the computer program that would allow Cernan to work the controls all the way down to the lunar surface.)

"It is not that you didn't trust it," recalls Cernan. "But you are only coming this way one time. And I'm sure not going to let some damn computer land it. The computer can give me all this information and I decide whether it's useful or not, but I'm the guy who is going to land it."

P-66 was about more than personal pride, however. The reconnaissance photographs that mission planners used to select the lunar landing sites had a resolution of 20 meters (65 feet), so a 19-meter boulder or crater that could easily tip the LM over may not have shown up. Even an appreciable slope could make unloading equipment

next to impossible, and a one-meter-wide rock, if the LM managed to land on it just right, could overpressure the descent engine bell and cause one healthy explosion. So when Cernan looked out his window and saw that *Challenger* was headed for a boulder field, he did what Armstrong, Conrad, Shepard, Scott, and Young did before him. He flew his LM out of harm's way.

To fly the LM, Apollo commanders found, was not an unnatural act. It was comparable to flying the helicopters that they trained in (both craft could hover; a helicopter would use the thrust generated by its rotor, whereas the LM would use the thrust of its descent engine). The commanders also spent hour upon hour in simulators. But early on, NASA knew that the simulators lacked fidelity in reproducing the final stages of landing, and real LMs were fragile and way too expensive to crater the home planet with, so they turned to the Lunar Landing Training Vehicle—the "Flying Bedstead."

"Of all the aircraft I've flown over the years," said Pete Conrad in a 1996 interview, "that was the one that scared the crap out of me."

The training vehicle was a jet- and rocket-propelled craft that looked like it was designed by a hyperactive kid with the world's biggest erector set. During lunar landing training, the astronaut would fly the LLTV to an altitude of several hundred feet, then switch to Lunar Simulation Mode. With five-sixths of the vehicle's weight neutralized by its jet engine, the astronaut controlled the descent by throttling two rocket engines, and he adjusted attitude by working 16 control thrusters. While the craft quickly earned a reputation as a valuable training tool, it was also regarded as squirrely and unforgiving. Despite the fact that three out of five Flying Bedsteads crashed (one with Neil Armstrong at the controls), LM commanders returning from the moon continued to give it a thumbs-up. "The LLTV is an excellent training vehicle for the final phases," said Conrad. "I think it's almost essential. I feel it really gave me the confidence that I needed."

With 300 feet to go, Apollo 17's Cernan needed all the confidence he could get since he was getting his first taste of real stick time after 250,000 miles.

*Michael Collins took this photograph of the Eagle, which carried crewmates Neil Armstrong and Buzz Aldrin.*







James A. McDivitt (foreground) and Russell L. Schweickart trained for Apollo 9 in the LM simulator at Kennedy Space Center in Florida.

"You mostly controlled by changing your attitude," says Cernan. "If I wanted to go a little left, I just roll to the left and the thrust vector would force me left. But now you're still drifting left, so you've got to take it out. So you roll right. And so your attitude, which would change the direction of thrust from the descent engine, is what pretty much controlled your movements."

The unique gravity and atmospheric conditions near the moon's surface made attitude changes a dramatic event. "In a helicopter on Earth you can pull the nose up four or five degrees to stop forward motion," says John Young, the commander on Apollo 16. "In the lunar module you'd pull it up 30 degrees."

While Cernan was in charge of *Challenger's* attitude and therefore its left/right, front/back velocity, he had to negotiate with PGNS to control the throttle. When P-66 kicked in, all Apollo commanders allowed PGNS to adjust the engine's thrust to maintain a constant rate of descent. If the astronaut wanted to hasten his rate of descent, he could change it in one-foot-per-minute increments by clicking downward on the T-shaped thrust/translational controller in his left hand. Conversely, if he wanted to slow his descent, he would click up.

So on Apollo 17, Cernan pitched and rolled and flattened and steepened *Challenger's* trajectory, and soon the boulders he could see through his window were well away from the reasonably level landing site ahead of him.

But nothing was assured until touchdown. "Below the 200-foot level, you are in the dead man's curve," says Cernan. "Past that point, if the descent engine quit burning for any reason, you would fall to the surface and crash before you could manually abort."

But *Challenger's* engine kept burning as Cernan and Schmitt began their final descent.

Schmitt: "Going down at five [feet per second]. 'The fuel's good. One hundred ten feet. Stand by for some dust.'"

As *Challenger's* radar altimeter passed through 80 feet, both commander and pilot noticed faint tendrils of dust being kicked up by the LM's descent engine. With no atmosphere to lift it skyward, the lunar dust silently skimmed the surface as it shot out from under *Challenger* in all directions.

On *Challenger's* instrument panel, between the commander and the LM pilot, there was a small blue light labeled "lunar contact." The bulb's sole purpose was to illuminate when one of three 5.6-foot-long probes that extended below *Challenger's* footpads crunched into moon and completed an electrical circuit. It was the LM pilot's responsibility to notice when the contact light went on.

"Contact," said Schmitt.

Cernan's gloved right hand immediately shot out. The LM's two most important buttons were the red abort button and the blue engine-stop button. Cernan hit the blue button. "That's when the bottom falls out," says Cer-

nan. "You hit zero-G again for a second and then you hit."

*Challenger* impacted the Valley of Taurus-Littrow at a leisurely three feet per second, well within the LM's structural limit of 10 feet per second. But because Cernan and Schmitt had lived in zero gravity for four days, the impact felt like a ton of bricks.

"The light came on," wrote Apollo 15 LM pilot Jim Irwin in his book, *To Rule the Night*. "I called 'Contact!' Dave hit the button to shut off the engine and we hit hard. It was the hardest landing I have ever been in. Everything rocked around and I thought the gear was going to fall off."

In any LM's life, landings are the moment of truth. "Touchdown is the most acceleration that the vehicle is going to feel," says Schmitt. "If something is going to break, it is probably going to break at touchdown."

Schmitt, like all LM pilots before him, was just as busy after touchdown as he was before. "There was no time for congratulations and popping of champagne corks," says Buzz Aldrin, who flew on Apollo 11. "It was a busy time to be ready to respond because your life and the mission depends on that." Schmitt spent the next couple of minutes analyzing everything from cabin pressure integrity to battery ampere hours remaining. Finally, after confirming that *Challenger* was not hemorrhaging fuel or otherwise in trouble, the commander and LM pilot took their first long look at their new digs.

Schmitt: "Oh man, look at that rock out there!"

Cernan: "Epic moment of my life."

It has been 29 years since the voyage of Apollo 17, and who can say when we'll go back to the moon. But when we do, rest assured there will probably be pilots who bet engineers on just how it will be done.

Former Grumman test pilot Tom Gwynne has some advice for future bettors: Get it in writing. "We won the bet," says Gwynne. "Although I'd have to say it was a hollow victory. I never did get a sip of champagne." —







## ► SIGHTINGS ◀

For aviation photographers, military operations are inherently dramatic subjects. Making images even more memorable requires seeking out new perspectives and more thrilling circumstances. Ted Carlson of Mission Viejo, California, who often turns to helicopters as particularly exciting subjects, recently strapped himself into the gunner's harness of an HH-60G Pave Hawk to capture a group of California Air National Guard PJs—pararescue jumpers—on a training mission above Moffett Federal Airfield near San Francisco (opposite). “I wanted to get the machine as well as the jumpers,” Carlson recalls, “and get them all together with the earth in the background and the field below.”

But he kept himself securely inside a CH-46E Sea Knight as he photographed a group of Marines being carried through the sky on a tether. They were practicing SPIE (special patrolling insertion and extraction) maneuvers at Camp Pendleton, near San Diego, when Carlson photographed them through the “hell hole” they had just descended through (right). And for a dramatic shot of an AH-1W Super Cobra hovering off the California coast, Carlson opened the canopy of the Cobra he was flying in and craned himself toward his subject (below). He was particularly pleased with the effect of the rippling water. “It’s a different image than you usually see,” he says. “The water patterns give it a more artistic look.”





# By the Numbers

## The X-Planes: X-1 to X-45

by Jay Miller. Specialty Press, 2001. 440 pp., color and b&w photos, \$59.95 (hardbound).

It's been 17 years since *X-Planes* was first published, but the book has remained a treasured resource. Owners of dog-eared copies will rejoice upon hearing that Jay Miller has updated his book to include the very latest in experimental air and space vehicles.

Listed here with encyclopedic diligence are, of course, the staples of test aircraft lore, such as the Bell X-1 and X-2 series, and the mighty North American X-15, considered the most successful test aircraft ever flown.

But Miller's book has always offered a look at the aircraft that may be largely unknown among aviation enthusiasts, such as the graceful Bell X-16, a high-

altitude reconnaissance aircraft canceled before it went into production. The X-16 resembles the later Lockheed U-2, which benefitted from high-altitude engine technology developed first for the Bell aircraft. Also highlighted is the X-28A, which, despite its sexy X-plane designation, was really just a homebuilt single-engine seaplane that the Navy briefly considered buying for civil police patrol in southeast Asia. *X-Planes* treats the also-rans with attention equal to that lavished on the stars.

Perhaps Miller's greatest contribution lies in his tenacious research methods—to him, there is no such thing as an insignificant detail. Know what the X-15's gaseous oxygen system was pressurized to? Miller does, and now, so do we: 1,800 pounds.

Aircraft newly covered in this updated edition include the two Joint Strike

Fighter contenders—the Boeing X-32 and Lockheed Martin X-35—as well as the canceled X-44, which would have been controlled by vectored thrust only, and the X-45A, an unmanned combat air vehicle.

Whether you're interested in the stats on an obscure technological dead end or on the very latest winged (or lifting body) design, Miller's *X-Planes* will most likely remain the definitive study to consult.

—John Sotham is an associate editor at Air & Space/Smithsonian.

## Logging Flight Time

by William K. Kershner. Iowa State University Press, 2001. 256 pp., \$32.95 (hardbound).

This new book is a delightful collection of William K. Kershner's articles, most of which have been published in various magazines, including *Air & Space/Smithsonian* (see "Heavy Duty," *Flights and Fancy*, Aug./Sept. 2000). Many of them are funny, most have a moral of some sort, almost all contain nuggets to think about, but every one of them is enjoyable.

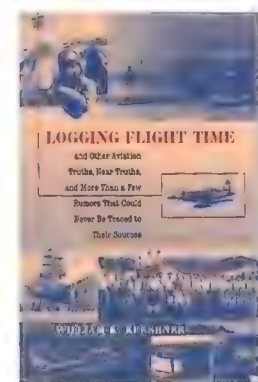
The book's subtitle, "And Other Aviation Truths, Near Truths, and More Than a Few Rumors That Could Never Be Traced to Their Sources," proves to be accurate. There are a few admitted exaggerations among the anecdotes, but the book contains mostly aviation truths and very little of the other stuff.

Kershner has been flying for more than 30 years, and was a naval aviator, a Piper corporate and test pilot, an instructor, and a private pilot flying

A single Hiller X-18 was built in 1958. Its two Allison YT40-A-14 turboprops gave the X-18 quick acceleration during a conventional takeoff, but the aircraft never successfully transitioned from forward flight to hover.



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## IN PAPERBACK

### Gateway to the Moon

by Charles D. Benson and William B. Faherty. University Press of Florida (800-226-3822), 2001. 416 pp., \$24.95 (b&w photos, paperback).



### Moon Launch!

by Charles D. Benson and William B. Faherty. University Press of Florida (800-226-3822), 2001. 336 pp., \$24.95 (paperback).



First published in 1978 as part of the NASA History Series, *Gateway* outlines the design and construction of the lunar launch complex at Kennedy Space Center, and *Moon Launch* provides an outline of the Apollo program.

simply for the fun of it. He has flown more than 100 types of airplanes. He was born into the perfect aviation era, and flew World War II F4U Corsairs while the Navy was transitioning to jets. Kershner then flew the notoriously underpowered Panther, Cougar, Shooting Star, and Banshee. Because he started flying immediately after World War II, in some of aviation's best and most prosperous years, he was still in the Navy when private flying hit its post GI-bill downturn. Kershner also had the great privilege of working directly with William T. Piper as his personal assistant. (At Piper, he also did experimental flight testing and demonstrations for military buyers.)

If you think you recognize Kershner's name, you've probably read *The Student Pilot's Flight Manual*, *The Advanced Pilot's Flight Manual*, *The Instrument Flight Manual*, *The Flight Instructor's Manual*, *The Basic Aerobatic Manual*, or possibly all five. This reviewer benefitted from the advanced pilot and instrument pilot manuals, which are accurate, sensible, and have just the right touches of humor. That's equally true of *Logging Flight Time*.

Every reader will find chapters that are especially appealing. Aviators will have had experiences similar to the author's, and non-aviators will enjoy the

stories' entertainment value.

Kershner has earned a number of awards, none of them insignificant, suggesting that for fliers, any tips the reader finds in the book are worth considering. The Federal Aviation Administration named him its General Aviation Flight Instructor of the Year in 1992; The Ninety-Nines gave him their 1994 Award of Merit; in 1997 the National Aeronautic Association named him an Elder Statesman of Aviation; and in 1998 his fellow flight instructors inducted him into the Flight Instructor Hall of Fame. Currently, he operates an aerobatic flight school in Sewanee, Tennessee, and some of his most interesting chapters concern lessons learned from, and lessons shared with, students there.

*Logging Flight Time* is a fairly thin book—only 256 pages—and easily read in a couple of sittings, if you find it as hard to put down as I did. Like a lot of university press books, it's a bit pricey, but an addition to your library that you'll read many times, always with pleasure.

—Thomas F. Norton is a freelance writer and former Navy pilot.

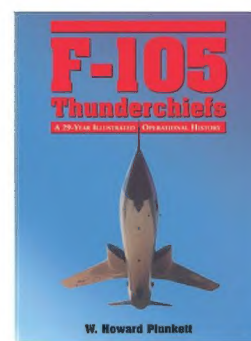
## F-105 Thunderchiefs: A 29-Year Illustrated Operational History

by Howard Plunkett. McFarland & Company (1-800-253-2187). 336 pp., \$55.00 (hardbound).

Readers will look to other publications to understand how the F-105 Thunderchief worked and why it worked the way it did, but in Howard Plunkett's *Thunderchiefs*, you'll find a concise operational history of this massive warbird, as well as detailed accounts of the 103 F-105s on display at museums or guarding main gates across America.

In Part I, Plunkett summarizes who operated the F-105, their missions, and where and when they flew. This operational summary dovetails nicely with Part II, the core of the book: exhaustively researched and detailed histories of individual surviving airframes now exhibited publicly. The author places several of these survivors, described in detail in Part II, into their operational contexts in Part I.

Plunkett recounts some of the odd fates that a number of F-105s have met, and describes some of the more unusual Thunderchief exhibit settings and the museum philosophies behind them. The approach that several museums have taken when they



repainted and re-marked their Thunderchiefs should make the reader pause and consider the powerful forces that sometimes compel museum curators to opt for dramatic displays at the expense of historic authenticity.

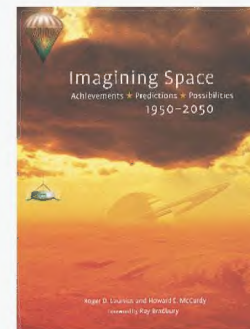
Each entry in Part II provides what a traveling Thunderchief enthusiast needs to know to find the remaining jets and understand their histories. A good black-and-white photograph accompanies each write-up, and the lengthy caption beneath each image presents operational details not given elsewhere. Again with reader convenience in mind, Plunkett includes a handy reference in Appendix 1 to the 103 extant F-105s, organized geographically by state. Unfortunately, Appendix 2 may sadden enthusiastic fans of this aircraft—it reveals the fate of another 118 Thunderchiefs that are not on public view but may well end up as scrap. —Russell Lee is a curator in the department of aeronautics at the National Air and Space Museum.

## ARTFUL SPACE

### Imagining Space: Achievements, Predictions, Possibilities 1950-2050

by Roger D. Launius and Howard E. McCurdy. Chronicle Books, 2001. 176 pp., \$35.00 (hardbound).

A juxtaposition of Chesley Bonestell's classic 1940s renditions with photographs of space travel, and today's imaginings of tomorrow's explorations.



### Building for Space Travel

edited by John Zukowsky. Abrams, 2001. 192 pp., color and b&w illustrations, \$39.95 (hardbound).

As the curator of architecture at the Art Institute of Chicago, John Zukowsky brings a designer's eye to his compilation of space travel concepts.





## CALENDAR

### August 11

Pearson Air Museum Fly-In Pancake Breakfast. Pearson Field, Vancouver, WA, (360) 694-7026.

### August 11 & 12

Beaver County Airshow. Beaver County Airport, Chippewa, PA, (724) 846-9922.

### August 18 & 19

Confederate Air Force's "Wings Over Frederick" Airshow. Frederick, MD, (301) 631-5357.

### August 19

National Aviation and Open Cockpit Day. Prairie Aviation Museum, Central Illinois Regional Airport, Bloomington, IL, (309) 663-7632.

### September 1

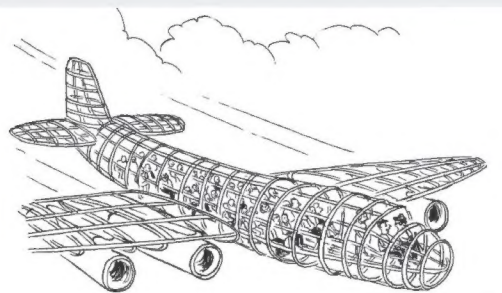
Aviation Chart Clinic and Pancake Breakfast. EAA Chapter 690. Sport Aviation Center, Briscoe Field, Lawrenceville, GA, (770) 613-9501.

### September 1-3

Cleveland National Airshow. Burke Lakefront Airport, Cleveland, OH, (216) 781-0747.

### September 9

Pottstown Aircraft Owners and Pilots Fly-In Breakfast. Pottstown-Limerick Airport, PA, (610) 933-4422.



"That was one acidic cloud bank."

Nick Downes

### September 15

Sulphur Springs Sport Aviation Association Fall Fly-In. Sulphur Springs Municipal Airport, TX, (903) 885-8363.

### September 15 & 16

EAA Chapter 36 Fly-In. Potomac Airpark, Berkeley Springs, WV, (717) 294-3221.

North Central EAA "Old Fashioned" Fly-In. Whiteside County Airport, Rock Falls, IL, (630) 543-6743.

### September 20-23

Reunion: Army Airways Communications System Alumni Association. Knoxville, TN, (253) 474-8128.

### September 21 & 22

National Biplane Association's Biplane Expo. Frank Phillips Field, Bartlesville, OK, (918) 622-8400.

### September 22 & 23

Mid Atlantic Air Museum's "Planes, Trains, and Automobiles" Weekend. Reading Regional Airport, PA, (610) 372-7333.

### September 27-30

Reunion: Second Bombardment Association. Holiday Inn Central, Omaha, NE, (916) 967-5678.

Unlimited Scale Racing Association Championship. Dos Palos, CA, (408) 654-9227, [www.usra-racers.org](http://www.usra-racers.org).

### September 29

EAA Chapter 914 Fall Gathering. Greenville Municipal Airport, TX, (903) 454-9579.

Organizations wishing to have events published in Calendar should submit them four months in advance to Calendar, Air & Space/Smithsonian, 750 9th St. NW, 7th Floor, Washington, DC 20560. Events will be listed as space allows.

## CREDITS

**"Cleared in Hot."** After two tours flying F-15s in Europe, Russell Gregory completed his Air Force career as an F-15 instructor pilot in Florida. He now flies for a major airline.

**Adventures in Pararescue.** Will Oliver is a Naval aviator, freelance business writer, and tireless storyteller.

**The Concorde Redemption.** Joseph Harriss is an American journalist based in Paris.

**The Reunion.** Freelance writer John Fleischman's last article for *Air & Space/Smithsonian* was "Beat Up and Beautiful" (Dec. 2000/Jan. 2001).

**That '70s Airshow.** Roger A. Mola is a freelance aviation journalist and pilot based in Arlington, Virginia. He's been to a lot of airshows.

**How Things Work: Winglets.** George C. Larson is the editor of *Air & Space*.

**All Space, All the Time.** Todd Kliman's work has appeared in the *New Yorker*, *Harper's*, and the *Washington Post*, among other publications.

**Save the Blimp Base.** John Sotham is an associate editor at *Air & Space*.

**Airports of Call.** Russell Munson began hanging around airports with his Kodak when he was 12, and with great good fortune, never grew up.

**"We Called It 'The Bug.'"** D.C. Agle thinks he's got what it takes to be a lunar module pilot. All he needs is an LM, a 363-foot rocket, and a note from his mother.



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# Hawk Captures Collier

The Collier Trophy for the year 2000 has been bestowed on Northrop Grumman's Global Hawk unmanned aerial vehicle (UAV), one of a new class of aircraft designed to carry out military missions without risking human lives (see "Predator: First Watch," Apr./May 2001).



Six years in development, Global Hawk claims the ability to fly farther without refueling and remain on station longer than any other aircraft—all without a crew on board and without any control from the ground. It is designed to loiter for 24 hours, 4,000 miles from its home base, at 65,000 feet. Global Hawk can fly from the United States to Africa, remain airborne as long as a day, and return home without refueling.

During one demonstration flight, Global Hawk took off from Florida, traveled up the East Coast, crossed the Atlantic, passed over Portugal, and returned to Florida—nonstop. More recently, in a series of flights over Australia, the aircraft stayed aloft as long as 33 hours.

Carrying cameras, radars, and other equipment, Global Hawk can conduct long-range reconnaissance and surveillance flights under conditions where it may not be practical or tolerable to use manned craft. Its sensors can photograph or map an area as large as

Illinois (40,000 square miles) in 24 hours. Images from the aircraft can be returned almost instantaneously. In a test over California, Global Hawk's electro-optical sensors clearly imaged two fire extinguishers on the ground from 56,000 feet. Because ground personnel can communicate with the

aircraft by satellite links and other means, Global Hawk is capable of not only flying pre-programmed missions but changing course or modifying its tasks as instructed.

The Coast Guard is exploring the Global Hawk's suitability for support of law enforcement operations, such as interdiction of drugs or other contraband. Assisting with detection of illegal immigration is another possible

assignment.

Sharing the Collier Trophy with Northrop Grumman are Rolls-Royce (turbofan engine), Raytheon (sensors and ground segment system), L3 Communications (communications system), the Defense Advanced Research Projects Agency (program manager), and the U.S. Air Force.

The Collier Trophy is awarded annually by the National Aeronautic Association to recognize the year's greatest achievement in American aeronautics or astronautics, with respect to improving the performance, efficiency, and safety of air or space vehicles. The 526-pound bronze trophy is kept on display at the National Air and Space Museum.

—Stuart Nixon

*Moments & Milestones is produced in association with the National Aeronautic Association. Visit the NAA Web site at [www.naa-usa.org](http://www.naa-usa.org) or call (703) 527-0226.*

## LOGBOOK

### Awards

NAA is proud to announce that Fay Gillis Wells is the winner of the 2001 Katharine Wright Award. This award is presented annually to a woman who has either provided encouragement, support, and inspiration to her husband, or made a personal contribution to the advancement of the art, sport, and science of aviation and spaceflight over an extended period of time. Fay Gillis Wells was honored at the Ninety-Nines Convention in July in Calgary, Alberta, Canada.

### Call for Nominations

Nominations are currently being accepted for the historic Wright Brothers Memorial Trophy. The trophy is awarded annually to a living individual for significant public service of enduring value, as a civilian, to aviation in the United States. "Public service" is interpreted to include both traditional public service—whether as a full-time employee of government or as an unpaid volunteer serving on a government commission or agency—and service that has made a major contribution of enduring value to the public. The nominations must be received in NAA's office by August 31, 2001. Call (800) 644-9777 for further information.

### Events

NAA is finalizing details for its Fall Awards Dinner, currently scheduled for November 5, 2001, in Washington, D.C. Some of the awards to be presented include the Elder Statesman of Aviation Award, the Katherine and Marjorie Stinson Award, and the Cliff Henderson Award for Achievement. For more details, check [www.naa-usa.org](http://www.naa-usa.org) or call (800) 644-9777.

U.S. National Aerobatic Championships, Denison, TX, Sept. 2–8, 2001. Call (970) 613-8099.

World Aeromodeling Championship (remote-controlled helicopters), Muncie, IN, Sept. 7–16, 2001. [www.modelaircraft.org/comp/2001f3cwcl.htm](http://www.modelaircraft.org/comp/2001f3cwcl.htm)